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May 13, 1960

Vol. 33, No. 5

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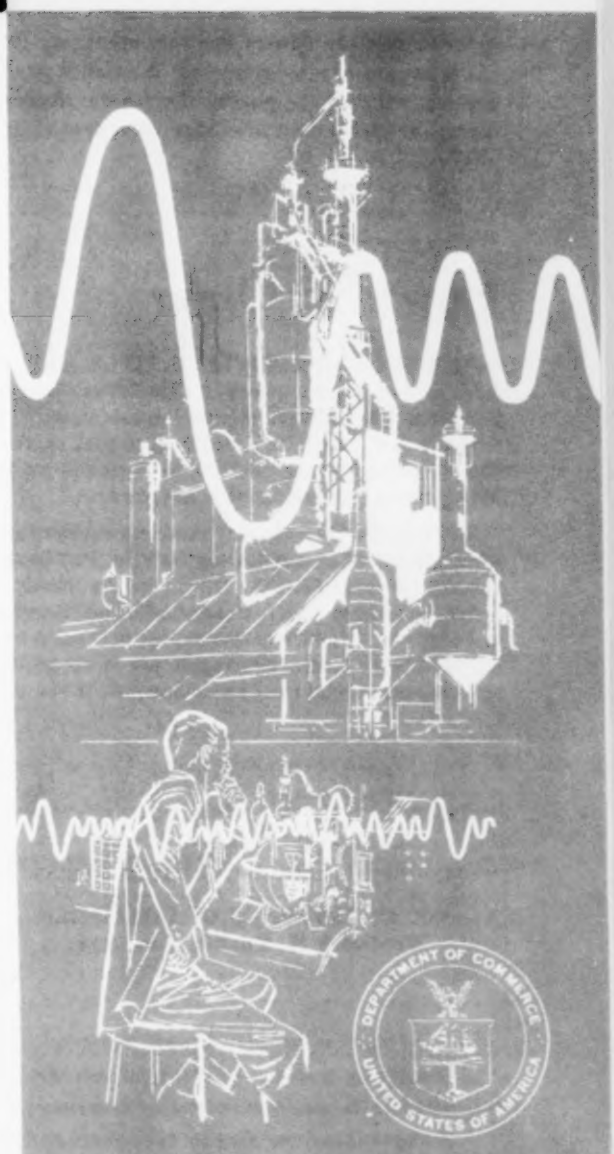

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Army Chemical Warfare Labs., Army Chemical Center, Md.
JOURNAL ARTICLES FISCAL YEAR 1958.
Oct 58, 27p. 77 refs. CWL Special pub. 4-6.
Order from LC mi$2.70, ph$4.80 PB 138 345

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Vol. 9. Titanium AD-13 812 to Zodiacal light
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Herner and Co., Washington, D. C.
BASIC RESEARCH RESUMES: A SURVEY OF BASIC RESEARCH ACTIVITIES IN THE AIR RESEARCH AND DEVELOPMENT COMMAND. Rept. on Contract AF 49(638)652. Dec 59, 341p. AFOSR-TR-59-204.
Order from OTS $5.00 PB 161 291

The purpose of Basic Research Resumes is to promote the broad accessibility of information about the activities of the Air Research and Development Command in the support and performance of basic research. In keeping with this theme of accessibility, the volume is designed in such a way as to accomodate a variety of viewpoints and purposes of use. Thus, Section I is designed primarily for administrative personnel, listing individual efforts by title only, and Section II is keyed to the needs of working scientists, giving a detailed description of each effort. Individual efforts are arranged in broad subject categories in both Sections I and II, and, within subject categories, they are listed alphabetically by the name of the organization or institution doing the research. As a further means of promoting maximum accessibility of the information it contains, Sections I and II of the volume are followed by three indexes. The first index categorizes research programs according to the names of the organizations or institutions in which they are being performed; the second arranges programs by the names of their principal investigators; and the third is a detailed index to the subjects or phases of subjects encompassed by the programs.

ASTRONOMY

Radio Astronomy Lab., U. of Alabama, University.
A RADIO STUDY OF THE SUN AND MOON AT MILLIMETER WAVELENGTHS, by F. H. Mitchell and Robert N. Whitehurst. Final technical rept. on Contract DA 01-009-ORD-456. 21 May 58, 13p. 5 refs. AD-161 317.
Order from LC mi$2.40, ph$3.30 PB 145 096

Solar and lunar temperatures and atmospheric attenuation were measured at selected millimeter wavelengths. The solar temperature is 4500°K at 6 mm, 5700°K at 7.5 mm, and 6500°K at 8.5 mm. No fluctuations were observed. The lunar temperature varies with phase angle in a rather complex manner from 125°K near new moon to 175°K about 4 days after full moon. The values of atmospheric attenuation are consistent with the Van Vleck theory, but absorption in some types of clouds is smaller than anticipated, particularly between 6 and 7 mm. A small effort was devoted to the analysis, design, and construction of a crystal-audio radiometer for the 3-4 mm wavelength region. (Portions of this report will not reproduce well)

Astrophysics

Harvard Coll. Observatory, Cambridge, Mass.
CLASSIFICATION OF SOLAR PROMINENCES - VIII - 1947, by Donald H. Menzel and F. Shirley Jones. Scientific rept. no. 3 on Contract AF 19(604)4962. Dec 59, 54p. AFCRC-TN-59-639.
Order from LC mi$3.60, ph$9.30 PB 144 958

See also PB 137 947

Harvard Coll. Observatory, Fort Davis, Tex.
SOLAR RADIO INTERFERENCE AT 125, 200, 425, 550 Mc/s, by A. Maxwell, W. E. Howard, III and G. Garmire. Scientific rept. no. 14 on Contract AF 19(604)1394. July 59, 84p. 48 refs. AFCRC-TN-59-459.
Order from LC mi$4.80, ph$13.80 PB 144 925

This report comprises a detailed analysis of the occurrence and intensity of solar radio bursts at four frequencies in the meter band. The report also includes a brief description of the sweep-frequency equipment and calibration procedures at the Fort Davis Station, a discussion of the characteristics and origin of the four spectral types of solar radio bursts, and a brief account of the association of the bursts with solar optical phenomena. The interfering effects of solar radio activity on radar and radio equipment are discussed at the end of the report.

National Bureau of Standards, Washington, D. C.
A MULTIPLET TABLE OF ASTROPHYSICAL INTEREST, REVISED EDITION. PART I. TABLE OF MULTIPLETS. PART II. FINDING LIST OF ALL LINES IN THE TABLE OF MULTIPLETS, by Charlotte E. Moore. Nov 59, 252p. 410 refs. Technical note 36.
Order from OTS $4.00 PB 151 395

Pending the completion of a current edition, the 1945 Multiplet Table is being reprinted here to meet continuing demands. The leading lines in 196 atomic spectra of 85 chemical elements are listed in related groups called multiplets. Estimated intensities, excitation potentials and multiplet designations are given for the individual lines, and each multiplet is assigned a number. An extensive bibliography covers the source material used for the compilation. The Table is presented in two parts: Part I includes the multiplets, with the spectra of each element being given in order of increasing ionization, and the elements in order of increasing atomic number. Part II is a Finding List in which all the lines in Part I are entered in order of increasing wavelength, with their multiplet numbers. The range of the Table is from 2951 A to 13164 A. A supplementary table of "Forbidden Lines" extends from 2972 A to 12645 A. (Author)

Oslo U. (Norway).
STUDIES IN THE GENERAL FIELD OF THE INTERRELATION OF SOLAR RADIATION IN THE OPTICAL AND METER-WAVE REGIONS WITH OTHER SOLAR PHENOMENA AND PHENOMENA TAKING PLACE IN THE TERRESTRIAL ATMOSPHERE, by Svein Rossland. Technical (Final) rept. for 1 July 54 - 31 Dec 56 on Contract AF 61(514)651-C. 21 Jan 57, 38p. 5 refs. AFCRC-TR-57-267; AD-117 172.
Order from LC mi$3.00, ph$6.30 PB 137 682

Researches in the field of solar radio noise: radiometric observations on 200 mc; general remarks on the registrations on 200 mc; analysis of registrations of solar radiation on 200 mc; a burst analysis receiver; construction of a triple-element interferometer for 200 mc; observations on 55 mc and 500 mc; and analysis of solar eclipse data of June 30, 1954. On sunspot magnetism: the magnetic buoyancy effect; the hypothesis of a toroidal magnetic field on the sun; the magnetic field of sunspots and the Evershed effect; and on short period variations in sunspot magnetic fields. Geometric structure of sunspots: structure of regular single sunspots; structure of double or multiple sunspots; variation of spot structure across the solar disk; and remarks on solar activity indices. Researches on prominences; and flares: theoretical considerations on prominences; and filter observations of prominences and flares. Solar origin of cosmic rays: Solar-terrestrial relationships. Notes on trial projects abandoned or postponed: investigations on the orientation of the axes of sunspots; proper motions of sunspots; the nature of spicules and their dependence on solar magnetic fields; and deformation of a fluid conducting sphere in a magnetic field.

BEHAVIORAL SCIENCES

Human Engineering

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TARGET RECOGNITION ON COMPLEX DISPLAYS, by Charles A. Baker, Dominic F. Morris, and William C. Steedman. Rept. on Criteria for the Design and Arrangement of Displays. Aug 59, 28p. 4 refs. WADC Technical rept. 59-418; AD-228 809.
Order from OTS $0.75 PB 161 310

A study was conducted to determine the speed and accuracy of form recognition as a function of: (1) the amount of distortion between the reference form and the target form, (2) the number of irrelevant forms in the target display, and (3) the stimulus properties of the forms involved. The stimulus forms were generated by filling in, on a statistical basis, some of the cells of a 90,000-cell matrix. The subjects were shown a reference photograph of a target and instructed to locate that target on a display containing numerous other forms. Both criterion measures, viz., search time and errors, increased as a function of: (1) an increase in the number of irrelevant forms on the target display, and (2) an increase in the difference between the resolution of the reference form and that of the target display. A quanti-

tative description of the targets, which can be used to predict relative target difficulty, was developed. (Author)

Aerospace Medical Lab , Wright Air Development Center, Wright-Patterson AFB, Ohio.
UTILIZATION OF MULTIPLE CUES IN PAIRED COMPARISONS, by James V. Bradley. Rept. on research at Antioch Coll. on Contract AF 33(616)6095. Sep 59, 44p. 13 refs. WADC Technical rept. 59-548.
Order from OTS $1.25 PB 161 419

Subjects were given one, two, or three cues with which to make an either—or decision. Certain hypotheses were formulated to describe the subject's thought process in utilizing the multiple cues, and mathematical models were constructed to simulate them. The models were then used upon data for the single-cue case to predict performance in the multiple-cue case. Predicted performance "data" were then compared with actually observed data for the same multiple-cue case, thus testing the predictive validity of the mathematical model and the tenability of the corresponding hypothesis. (Author)

Institute for Cooperative Research, Johns Hopkins U., Baltimore, Md.
APPARENT AND REAL RESOLUTION IN RADAR VISIBILITY, by Harold W. Hake and Emanuel Averbach. Rept. on Human Engineering Analysis of Weapon Systems, Contract AF 33(038)22642. Sep 55, 15p. 9 refs. WADC Technical rept. 55-459; AD-94 316.
Order from LC mi$2.40, ph$3.30 PB 145 334

Differential sensitivity for luminance differences existing in two spatially separated homogeneous fields was measured under three conditions of viewing. In the first the comparison fields, presented on a cathode ray tube face, were separated by darkness; in the second the fields were joined by a transition area in which luminance increased linearly from the value presented in the darker field to that presented in the lighter field. A third condition controlled for the decrease in size of the fields which occurred with increasing separation of them.

Naval Training Device Center, Port Washington, N. Y.
SENSORY INTERACTION AND RESPONSE CAPACITY, by Alexander Goldman. June 59, 60p. 21 refs. Technical rept. NAVTRADEVCEN 789-11-1; AD-225 517.
Order from LC mi$3.60, ph$9.30 PB 144 948

An attempt was made to determine whether the operator in a man-machine system with very high input rates can perform more efficiently when the sensory inputs are through one sense modality or divided between 2 sense modalities. A research tool was developed which permits the display of a target to be tracked so that the movement in either the horizontal or vertical axis may be displayed on the video component while the other is displayed on the audio component; or the movement in both planes may be shown on the video alone; or the movement in both planes may be shown on the video while one of them is also presented in the audio display. Provision was made for a second audio display, so that movement in both horizontal and vertical planes may be presented as audio signals. Any standard control may be used to track the target. Thirty-two Army enlisted men were used as subjects. Results indicated that compensatory tracking was more proficient when the display was entirely video than when it was partly presented by the video component and partly by the audio. When the display was entirely visual, single control (joystick) was superior to two-handed (linear) control. When the display was mixed audio and video, the two-handed control was superior.

Naval Training Device Center, Port Washington, N. Y.
TRACKING PERFORMANCE RELATED TO DISPLAY CONTROL CONFIGURATIONS, by James J. Regan. 23 Jan 59, 37p. 35 refs. Technical rept. NAVTRADEVCEN 322-1-2.
Order from LC mi$3.00, ph$6.30 PB 144 966

The form in which information is presented to and in which control is exercised by operators in instructor's stations and other training equipments can have important effects on the tracking performance of these operators. Questions frequently arise concerning the way in which these display-control configurations should be designed. This research was designed to supplement the information in this area especially as these decisions are affected by a variety of related variables including practice.

Personnel and Training

Adjutant's General's Office, Washington, D. C.
ABSTRACTS OF PRB RESEARCH PUBLICATIONS FY 1959, by A. J. Drucker and Emma E. Brown. Oct 59, 35p. PRB Technical Research Note 105.
Order from LC mi$3.00, ph$6.30 PB 145 110

This volume identifies both by publication serial number and by Research and Development Research Task all research publications prepared and released by the Personnel Research Branch of The Adjutant General's Office in FY 1959. The listing includes 5 Technical Research Reports, 9 Technical Research Notes, 9 Research Studies, and 14 Research Memorandums. Where a publication has been abstracted, the principal research findings have been described in non-technical language as much as possible.

Adjutant General's Office, Washington, D. C.
DEVELOPMENT OF THE ARMY QUALIFICATION BATTERY, AQB-1, by A. G. Bayroff, Leonard C. Seeley, and Alan A. Anderson. Oct 59, 18p. 2 refs. PRB Technical research rept. 1117.
Order from LC mi$2.40, ph$3.30 PB 145 075

The operational requirement that an enlisted man have at least two aptitude area scores of 90 or above to qualify for Army service necessitated more intensive screening of applicants for enlistment and SS

registrants, particularly of men in the Category IV aptitude level. In 1958 the ACB was introduced at all Armed Forces Examining Stations (AFES) as a screening measure. Development and standardization of the Army Qualification Battery composed of tests which are shorter and more appropriate to a limited ability range than the ACB tests is described. The eight AQB tests (four AFQT subtests and four additional short tests parallel to ACB tests) were found to yield satisfactory measures of scores on individual ACB tests. The AQB composites were found to be closely related to corresponding ACB aptitude area scores. As differential measures of the aptitudes of Category IV personnel, the AQB composites can be expected to function as effectively as ACB aptitude areas in identifying the least useful potential soldiers and in appropriately classifying those accepted. (Author)

[Aerospace] Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AN EVALUATION OF THE EFFECTIVENESS OF A SELF-TUTORING APPROACH APPLIED TO PILOT TRAINING, by Richard S. Hatch. Rept. on Human Factors in the Design of Training Equipment. July 59, 26p. 4 refs. WADC Technical rept. 59-320.
Order from OTS $0.75 PB 161 440

This study concerns the problem of insuring ready recall of a large body of in-flight job information for Air Force pilots. The effectiveness of a voluntary self-tutoring approach utilizing one type of "game appeal" device was examined. Two matched groups of Air Force pilots were pretested on their knowledge of instrument flying information. The device was then installed in the crew lounge of one of the groups. No device was available to the other group. After a 2-month period both groups were post-tested. Despite the fact that minimal exposure to the machine occurred, players improved significantly on the criterion tests while non-players did not improve. Factors pertinent to the interpretation of the results and implications for further research were discussed. (Author)

Applied Psychological Services, Wayne, Pa.
POST-TRAINING PERFORMANCE CRITERION DEVELOPMENT AND APPLICATION: THE SESR PROGRAM: COMMISSIONED AND PETTY OFFICER OPINIONS, by Arthur I. Siegel, Philip Federman and Milton Richlin. Rept. on Contract Nonr-2279(00). Feb 59, 28p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 144 791

A series of interviews was held with a small sample of supervisory fleet personnel in order to determine reactions to the Selective Emergency Service Rates program. Problems in assigning the specialized man in accordance with his specialty were evident, especially in understaffed squadrons. Opinion was generally divided regarding the technical superiority of the SESR program trained individual as compared with the graduate of the previous training program. It was generally thought that the SESR program graduate reaches competency earlier but many supervisors preferred the graduate of the previous program because of his more general usefulness. The supervisors thought the SESR program graduate to be accepted by squadron personnel and maintained that few morale differences were evidenced between the products of the two training programs. Ongoing, longitudinal study of the SESR program was suggested for more definitive conclusions. (Author)

Aviation Psychology Lab., U. of Illinois, Urbana.
TRANSFER OF TRAINING IN FLIGHT PROCEDURES FROM SELECTED GROUND TRAINING DEVICES TO THE AIRCRAFT, by Dora J. Dougherty, Robert C. Houston, and Douglass R. Nicklas. Rept. on Contract N6ori-71-16. 1 Sep 57, 97p. 17 refs.
NAVTRADEVCEN Technical rept. 71-16-16; AD-149 547.
Order from LC mi$5.40, ph$15.30 PB 138 224

Four configurations of ground training devices were evaluated for training pilots to perform in-flight procedures. These were a photographic mockup of the cockpit, a partly activated trainer, an aircraft flight simulator, and the combination of a part task (procedures trainer) and time-shared tracking task. All 4 methods provided good learning situations. The groups trained on procedures trainers and the flight simulator showed the highest degree of transfer to the first air trial. Neither method was superior in this respect. Training on an operational flight trainer or a procedures trainer did not significantly differ from the same amount of training in the aircraft itself. The photo mockup provided the best learning situation as measured by performance in the ground situation. By the third air trial, no differences could be observed as a result of training with the different methods. The group that learned procedures while practicing the tracking task had the most difficulty in learning. Transfer to the aircraft was not quite as high as practice in the procedures trainer alone. Time sharing while learning procedures did not facilitate the in-flight performance of procedures and flight skills.

Electric Boat Div., General Dynamics Corp., Groton, Conn.
TRAINING EFFECTIVENESS AS A FUNCTION OF SIMULATOR COMPLEXITY, by John M. Newton. Rept. on Contract N61339-458. Sep 59, 94p. 10 refs. Technical rept. NAVTRADEVCEN 458-1.
Order from LC mi$5.40, ph$15.30 PB 145 165

Although generally, there were no significant differences among the proficiency scores obtained under the five conditions, the general trend is for the mean scores to be ranked in order of simulator complexity. Thus, scores of the subjects trained on the same simulator on which they were tested were consistently higher; subjects trained on the PACE computer were second, followed by those trained with the 20-amplifier Donner computer, 18-amplifier Donner computer with motion in tilt-table and the 18-amplifier Donner computer with no motion in the tilt-table. (Author)

Family Relations Center, San Francisco, Calif.
THE REHABILITATION OF NAVAL DISCIPLINARY OFFENDERS, by Harry N. Coffin and C. E. Keeler. Status rept. no. 7 (Annual technical rept. no. 3) on

Contract Nonr-1535(00). 13 Jan 58, 15p. AD-159 624.
Order from LC mi$2.40, ph$3.30 PB 138 287

The following studies, conducted at the US Naval Retraining Command, were abstracted: (1) revision and refinement of a theory of interpersonal maturity, and the development of techniques for the measurement of maturity levels; (2) the prediction of military delinquency, (3) the prediction of success on restoration to military duty; (4) program effectiveness in Naval retraining; (5) living group study; (6) sociometric analysis-interpersonal maturity and role perception; (7) implicit personality theories of living group study supervisors and consultants; (8) inverse factor analysis of living group study supervisors' and consultants' personality characteristics; (9) interpersonal variables related to recidivism in military delinquency; (10) personality test factors in a civilian delinquent population; (11) living group controls; (12) factors related to ability to predict restoration success; and (13) personality test factors in a population of confined military delinquents.

Family Relations Center, San Francisco, Calif.
THE REHABILITATION OF NAVAL DISCIPLINARY OFFENDERS, by J. Douglas Grant. Annual technical rept. no. 4 on Rehabilitation Research, Contract Nonr-1535(00). 28 Feb 59, 31p. 69 refs.
Order from LC mi$2.70, ph$4.80 PB 144 820

Abstracts of the various panels of the research conducted at the U. S. Naval Retraining Command, Camp Elliott, San Diego, California. This research program is concerned with the rehabilitation of Naval disciplinary offenders.

Georgetown U. Medical Center, Washington, D. C.
A TEST PROGRAM FOR TWO ANTARCTIC EXPEDITIONS: 1956-1959, by Herbert Zimmer. Final rept. for 1 June 57-15 Dec 58 on Contract Nonr-1530(06). 15 Dec 58, 97p.
Order from LC mi$5.40, ph$15.30 PB 145 091

This report consists of the tests, checklists, rating forms, instructions, schedules, etc., used in Operation Deepfreeze III, in order to make them available to future investigators, since they are not published elsewhere.

Harvard Graduate School of Education, Cambridge, Mass.
ON IDENTITY AND LEVEL OF OCCUPATIONAL ASPIRATION, by David V. Tiedeman and Jiwan Lal Pandit. Rept. no. 9 on Harvard Studies in Career Development, Technical rept. no. 5 on Contract Nonr-1866(31). Dec 58, 35p. 13 refs.
Order from LC mi$3.00, ph$6.30 PB 145 088

This investigation considers only the reports an individual makes about himself. No comparison with the opinion of any other person is yet attempted. In this regard, this study falls short of considering an important aspect of Erikson's explanation of identity, namely the actual evaluations others hold of the one whose identity is investigated. Two schools were used to provide some indication of the stability of the results. Pupils expressed their opinions with regard to themselves and members of the following social system.

Human Resources Research Office, George Washington U., Washington, D. C.
AN IMPROVED ADVANCED INDIVIDUAL TRAINING PROGRAM FOR ARMOR, by Eugene F. MacCaslin, Arnold B. Woodruff, and Robert A. Baker (Army Armor Human Research Unit). Rept. on Contract DA 49-106-qm-1. Dec 59, 82p. 15 refs. Technical rept. 59.
Order from LC mi$4.80, ph$13.80 PB 145 134

As the final phase in research on tank crew proficiency, an experimental Armor AIT program was developed to improve training for the jobs of tank driver, loader, and gunner. Performance of a company trained by the six-week experimental program was compared with performance of a control company just completing the standard eight-week AIT program. The experimental company performed better than the control company in 11 of 21 skill areas tested, including the more complex gunnery skills essential in combat, and scored comparably in seven skill areas. Adoption of the experimental program was recommended as requiring less time and training cost, without lessening proficiency in essential armor crew skills. The principles and techniques used in the training program for improving instruction were recommended for use, where appropriate, in other Army training programs. (Author)

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
THE USE OF AN OPERATIONAL GAME AS A METHOD OF TASK FAMILIARIZATION, by R. G. Kinkade and J. S. Kidd. Rept. on Contract AF 33(616)3612. July 59, 22p. 8 refs. WADC Technical rept. 59-204.
Order from OTS $0.75 PB 161 439

An evaluation of the usefulness of an "operational game" as a system task-familiarization device was attempted. A sample of 20 Ss was divided into two groups after completion of component skill training. One group was given 5 hr. of practice on an operational game derived from a radar air traffic control task. The other group went directly into system training on the end task provided by an electronic ATC simulator. Comparison of the two groups' proficiency during system training on the end task indicates a consistent superiority for the group having had preliminary practice with the operational game. It was hypothesized that the positive transfer effects observed were due to the similarity between the decision-making requirements of the two situations. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
THE DEVELOPMENT OF A NON-COGNITIVE BATTERY: PREDICTION OF RADIOMAN PERFORMANCE, by David Kipnis and Albert S. Glickman. June 59, 28p. 9 refs. BuPers Technical Bulletin 59-14; AD-225 616.
Order from LC mi$2.70, ph$4.80 PB 144 674

In this third in a series of reports on the development of tests of temperament and personality for predicting the performance of enlisted personnel, a number of experimental tests of temperament and personality were administered to entering students at Class A Radioman School. Final grades and marks in code-receiving were obtained from school records. Evaluations of duty performance were obtained from each Radioman's most immediate supervisor about one year after testing. It was found that some of the experimental tests were reasonably effective in predicting both the school grades and the level of performance of duty of the enlisted man. Because of the promise indicated in this study, the research with tests of temperament and personality is being continued and expanded to include different ratings. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
RELATIVE WEIGHTS OF OFFICER CANDIDATE COURSE GRADES, by Byron Groesbeck. June 59, 16p. 1 ref. BuPers Technical Bulletin 59-7; AD-227 795.
Order from LC mi$2. 40, ph$3. 30 PB 144 539

A comparison was made between (1) the weights prescribed by BuPers for OCS course grades, (2) the weight actually received by each course grade when multiplied by the prescribed weight and summed to form the final grade, and (3) the weight that would be received by each course grade if the final grade were a simple sum of the original course grades. The results obtained from OCS classes 34 and 35 were almost identical. If the final grade were a simple sum of course grades, the engineering, navigation, operations, and naval weapons grades would tend to have greater weight in determining the final grade than would the orientation, seamanship, and military aptitude grades. When the course grades are multiplied by the prescribed weights and summed to form the final grade, the weights of the course grades correspond fairly well to the prescribed weights. Exceptions are the navigation grade, which receives relatively more weight than desired, and the military aptitude grade, which receives relatively less weight than desired. (Author)

Personnel Lab., Lackland AFB, Tex.
PREDICTION OF AIR FORCE TRAINING AND PROFICIENCY CRITERIA FROM AIRMAN CLASSIFICATION BATTERY AC-2A, by Leland D. Brokaw. Oct 59, 20p. 2 refs. WADC-TN-59-196; AD-228 445.
Order from LC mi$2. 40, ph$3. 30 PB 144 792

The validity of the Airman Classification Battery AC-2A during the first 14 months of its administration was determined. Data are presented for 46 specialties for which both technical training and job proficiency criteria were available, in the form of Final School Grades and Airman Proficiency Test Scores. Technical training validities are given for an additional 20 technical schools. The expectation of some reduction of general validity as a function of maximizing differentiating power was realized. Slightly greater drops in general validity than had been anticipated were found in the mechanical and administrative aptitude clusters, while the remainder of the battery showed validity comparing favorably with the preceding Battery AC-1B. The AC-2A Battery demonstrated itself to be an effective instrument for differential classification; interpretation of its validities are made in this frame of reference. Current Air Force policies require a different kind of instrument for most effective recruitment and placement of new airmen. (Author)

Psychology

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A DEVICE FOR MEASURING CROSS MOTOR BEHAVIOR IN PRIMATES, by Donald W. Ormiston, Frederick H. Rohles, Jr. and Marvin E. Grunzke. Rept. on Behavioral Effects of Unusual Environmental Conditions. Oct 59, 9p. WADC Technical note 59-353.
Order from OTS $0. 50 PB 161 410

To meet the need for a method of measuring gross motor behavior as affected by various gravitational forces, a jumping device for primates was developed consisting of a large box with a stand at each end and a well in the middle. The well carried a constant electrical charge. Shock, preceded by a tone, was used to make the animal jump over the well to the opposite side. Motion pictures of the jump, as viewed through the plexiglas side and top, allowed measurement of the height and distance of the jump. Other possible uses of the device are discussed. (Author)

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
JUDGMENTS OF THE RELATIVE FREQUENCY OF SEQUENTIAL BINARY EVENTS: EFFECTS OF FREQUENCY DIFFERENCES, by Dwight E. Erlick. Rept. on research done at Antioch Coll. on Contract AF 33(616)6095. Oct 59, 22p. 3 refs. WADC Technical rept. no. 59-580.
Order from OTS $0. 75 PB 161 426

This study concerns accuracy of discriminating which of two events occurred more frequently when both are presented in a random sequential order, at a constant rate, too fast to permit counting. Subjects were required to indicate on a 10-cm. scale the proportion of the total time occupied by the more frequent event. Each judgment was based on a total of 100 events, with the overall per cent differences between the occurrence of the two elements being 0, 4, 10, and 14. The mean proportion of correct judgments increased as the per cent difference between the frequency of the events increased, with an 8. 3 per cent difference being discriminated correctly 75 per cent of the time. The actual proportion of the trial occupied by the more frequent event was over estimated at the higher per cent differences. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
ALTERED ENVIRONMENTS FOR BIOLOGICAL SPECIMENS. I. RESTRAINT CONDITIONING OF LARGE BIOLOGICAL SPECIMENS, by William E. Ward. Oct 59, 20p. 2 refs. AFMDC-TN-59-36.
Order from LC mi$2.40, ph$3.30 PB 144 795

A report describing the initial phase of a study of the psychobiology of restrained immature chimpanzees under conditions of isolation and aircraft flight is presented. Restraint was accomplished by securing the subjects in small nylon vests and buckling the latter to chairs developed for this purpose. The subjects adapted rapidly to restraint and at the end of four months were sitting restrained on the ground for six hours each day under isolated conditions, as well as flying restrained for four hours each week. (Author)

Applied Mathematics and Statistics Lab., Stanford U., Calif.
MARKOV LEARNING MODELS FOR MULTIPERSON SITUATIONS, I. THE THEORY, by Patrick Suppes and Richard C. Atkinson. Technical rept. no. 21 on Contract Nonr-225(17). 20 Feb 59, 79p. 26 refs.
Order from LC mi$4.50, ph$12.30 PB 144 957

Army Medical Research Lab., Fort Knox, Ky.
DIFFERENTIAL SATIATION EFFECTS UNDER FIXED-RATIO AND REGULAR REINFORCEMENT SCHEDULES, by P. L. Carlton. Rept. on Psychophysiological Problems. 28 May 58, 8p. 3 refs. Rept. no. 318.
Order from LC mi$1.80, ph$1.80 PB 144 786

Two water deprived rats were extensively trained on concurrent fixed-ratio and regular reinforcement schedules. After their performance had stabilized, the effects of satiation on the behavior generated by these two schedules were observed. It was noted that satiation served to increase the duration of periods of no responding under the fixed-ratio schedule without altering the response rate. On the other hand, responding under the regular reinforcement schedule was unchanged. (Author)

City Coll. of the City of New York.
PERSONAL NEEDS AND THE ACCEPTANCE OF A NEW GROUP AS A REFERENCE GROUP, by Ruth E. Hartley. Technical rept. no. 6 on Acceptance of a New Reference Groups, Contract Nonr-1597(01). 15 Feb 58, 16p. 16 refs. AD-154 874.
Order from LC mi$2.40, ph$3.30 PB 138 286

The relationship between the perceived satisfaction of a complex of needs and the acceptance of a new membership group as a reference group was examined. The following hypotheses were formulated and tested: (1) the more successful a new group is perceived to be in meeting the personal needs of an individual, the more likely he is to accept it as a reference group; (2) the more successful a new group is perceived to be in meeting the personal needs of an individual, in comparison with his established groups, the more likely he is to accept it as a reference group; and (3) the effectiveness of the new group in meeting the needs of the individual, as shown by the individual's acceptance of the group as a reference group, is defined by the importance assigned by the individual to the needs that the group meets, as well as by the individual's perception of the degree to which given needs have been met by the group. Subjects were 146 male freshmen at a municipal college, and data were obtained by means of questionnaires. All the hypotheses were supported by the data. The data indicated that the absolute level of the ability of a given group to fulfill the needs of its members is more significant than its comparative standing in this respect in relation to other membership groups. The data also suggested the operation of a general personality tendency, evidenced by the comparative importance assigned to one's needs, in association with a tendency to the ready acceptance of a new group as a reference group.

Connecticut Coll., New London.
PSYCHOLOGICAL STRESS AND RELATED CONCEPTS: INDICES TO A BIBLIOGRAPHY, by Mortimer H. Applezweig. Supplement to Technical rept. no. 7 on Motivation Research Project, Contract Nonr-996(02). Jan 58, 37p. AD-158 086.
Order from LC mi$3.00, ph$6.30 PB 138 257

(See also PB 138 221)

Connecticut U., Storrs.
VERBAL GENERALIZATION: A THEORETICAL RATIONALE AND AN EXPERIMENTAL TECHNIQUE, by W. A. Bousfield, B. H. Cohen, and G. A. Whitmarsh. Technical rept. no. 23 on Contract Nonr-631(00). Jan 58, 10p. 3 refs.
Order from LC mi$1.80, ph$1.80 PB 138 336

The study describes a purely verbal method for studying verbal generalization. A pilot study making use of this method yielded results interpreted as giving some support for the proposed rationale.

Dunlap and Associates, Inc., Stamford, Conn.
MOTOR HABIT INTERFERENCE: A RESUME OF THE LITERATURE AND THE DEVELOPMENT OF PRINCIPLES FOR ITS MINIMIZATION IN TRAINING, by Alfred F. Smode, Jerome C. Beam, and Jack W. Dunlap. Rept. on Contract Nonr-2515(00). Jan 59, 109p. 148 refs.
Order from LC mi$5.70, ph$16.80 PB 144 750

This report presents a detailed discussion of habit interference in motor performance. It is expressly written for operating personnel responsible for the conduct of training in the military, and for psychologists engaged in the area of training research. Three major sections are developed. Chapter I presents a technical review of the literature on what currently is known on habit interference. A brief non-technical summary of the empirical findings on habit interference is presented at the end of the chapter for those individuals more interested in the

essence of the empirical data. Chapters II and III are devoted to the development of techniques and procedures for minimizing the effects of interference in perceptual-motor learning. Chapter III is devoted to the development of categories of behavior which embrace the variety of motor-manipulative jobs for which military personnel are trained. Within this framework principles and hypotheses are developed for minimizing habit interference for the categories or types of motor behaviors identified.

Educational Testing Service, Princeton, N. J.
LEVEL OF ASPIRATION MEASURES AND SELF-ESTIMATES OF PERSONALITY IN RELATION TO ACHIEVEMENT MOTIVATION, by Henry N. Ricciuti and Douglas G. Schults. Rept. on Contract Nonr-694(00). Jan 58, 25p. 12 refs. AD-154 568.
Order from LC mi$2.70, ph$4.80 PB 138 338

The primary purpose of this research was to investigate the relationship between level of aspiration measures derived from two cognitive tasks and achievement motivation scores obtained by means of the thematic apperception method. A secondary purpose was to compare the achievement motivation scores with several indices of reported self-perceptions with respect to various personality traits. The subjects were 61 male and 34 female college students. For measuring achievement motivation, the general technique developed by McClelland and his co-workers was used. A small and generally negative relationship was found between achievement motivation and self-criticalness, regardless of the perceived status, on the Check List traits. The pattern of correlations indicated a sex difference similar to that obtained with the aspiration measures. There was also a suggestion of a low, negative correlation between achievement motivation and favorable self-appraisal on the Check List traits.

Michigan U. Research Inst., Ann Arbor.
LABORATORY FACILITIES EMPLOYED IN PSYCHO-MEMORY EXPERIMENTS, by Robert C. Bilger. Rept. on Contract AF 49(638)369. Sep 59, 20p. 2 refs. Technical memo. no. 72; 2803-2-T; AFOSR-TN-59-923.
Order from LC mi$2.40, ph$3.30 PB 144 793

Equipment and operating procedures used in psychophysical memory experiments at Electronic Defense Group are described and illustrated. This equipment gives precise control of signal parameters and enables one to efficiently collect the large quantities of data required for specification of the parameters of the human hearing mechanism. (Author)

New Mexico U., Albuquerque.
RELATIONSHIPS AMONG THE TRAITS OF THE PERCEIVER AND THOSE OF THE PERCEIVED IN IMPRESSION FORMATION, by David T. Benedetti, Robert M. Morgan, and David W. Bessemer. Final rept. on Contract AF 49(638)33, Phase 4. Sep 59, 51p. 14 refs. AFOSR-TR-59-187.
Order from LC mi$3.60, ph$9.30 PB 144 787

Two questions were experimentally investigated: To what extent are the impressions one forms of other persons contingent upon the extent to which one possesses the traits one perceives in the others? When one perceives another person, is the resulting impression an integrated or a piecemeal cognition? College students were given controlled information about a series of hypothetical persons. The impressions they formed were measured in a variety of ways. The major conclusions were: (1) In general, one's personality traits are not potent, overall determiners of the impressions one forms of others, although there are certain selective relationships here; (2) Impressions formed of other people clearly tend to be integrated cognitions, in the sense that judgemental responses based upon them are typically intercorrelated. This study is predicated upon the assumption that since interpersonal behavior is in part a function of personality impressions, the prediction and control of such behavior in military or other practical situations calls for grounding in knowledge gained by basic research.

New York U., N. Y.
CONCEPT FORMATION AS A FUNCTION OF COMPETITION BETWEEN RESPONSE PRODUCED CUES, by Howard H. Kendler and Alan D. Karasik. Technical rept. no. 1 on Studies on the Experimental Analysis of Problem Solving Behavior, Contract Nonr-285(30). 15 Nov 57, 15p. 10 refs. AD-147 130.
Order from LC mi$2.40, ph$3.30 PB 137 859

A mediational S-R formulation was applied to verbal concept formation behavior. It was hypothesized that concept formation depended not only on S responding to words that belong to a concept (relevant words) with a common implicit response, but also S responding to the words that do not belong (irrelevant words) with different implicit responses. It was predicted, therefore, that different sets of irrelevant words should influence the manner in which a set of relevant words are combined into a common concept. This prediction was confirmed. The results suggested that the speed of concept formation varied directly with the ability of the irrelevant words to evoke implicit responses that are distinctively different from those required for the relevant words. (Author)

Ohio State U. Research Foundation, Columbus.
ORIGINALITY IN GROUP PRODUCTIVITY, by Pauline N. Pepinsky and Harold Pepinsky. Technical rept. no. 4 (Annual) 1 Jan-15 Nov 58, on Contract Nonr-495(15). 15 Nov 58, 20p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 144 851

This report is a resume of the work accomplished and in progress and is directed toward these general objectives: (1) the identification and measurement of behaviors that are independent and original, but contribute to group productivity; and (2) the determination of conditions leading to such behaviors, and the experimental testing of such effects.

Ohio State U. Research Foundation, Columbus.
THE RELATIONSHIP OF PHONETIC STRUCTURE TO THE INTELLIGIBILITY OF WORDS SIMULTANEOUSLY RECORDED AT EAR AND LIPS, by Henry M. Moser, Herbert J. Oyer and Susan M. Wolfe. Technical rept. no. 47 on Contract AF 19(604)1577. Apr 58, 28p. 15 refs. AFCRC-TN-58-54; AD-152 646.
Order from LC mi$2.70, ph$4.80 PB 137 943

Previous study has shown that when speech signals were recorded at lips and left ears of speakers, and fed to headsets of trained listeners at specified S/N ratios, signals, origin ear, were significantly more intelligible than signals, origin lips. A comparative analysis is made of phonetic elements of listener response to speech signals, origins ear and lips, elicited in the earlier study. Listener responses totaled 72,000. Listeners highly trained on fifty words tend to restrict substitute responses to words within the list for signals of both origins. Fewer substitutions of words from outside the original list occur as noise in the listening condition becomes more destructive. Substitutions remain relatively constant between origins through ratios. Omissions for stimuli, origin lips, increase more rapidly. Number of sounds in the test stimuli had no differential effect on intelligibility when related to origin. The frequency of occurrence of two, three, four, and five sound word substitutes is in almost complete agreement with frequency of occurrence of two, three, four, and five sound words in the test list. Analysis of intelligibility errors relative to vowels and diphthongs in the test list revealed that words containing [æ, ʌ, ɑ, ɔ, ɑʊ, and ɔɪ] were less intelligible from origin ear, than origin lips through S/N ratios. (Author)

Psychological Labs., Carnegie Inst. of Tech., Pittsburgh, Pa.
VARIABLES UNDERLYING SOCIOMETRIC STATUS. V. CONSIDERATION OF SOME VARIABLES RELATIVE TO LEADERSHIP, by E. P. Hollander. Technical rept. on Contract Nonr-1849(00). Mar 59, 16p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 145 214

This is a report of findings from an investigation of sources of leadership status within eight training sections of naval officer candidates numbering thirty each. Variables of accuracy of estimate of other's values, academic performance, personal desire for social approval, and motivation to maintain affiliation with the section, were of particular concern. Except for academic performance, which quite usually reveals a positive relationship to leadership status in such groups, none of the other variables yielded significant relationships beyond trends. It is suggsuggested that classes of this sort may not behave as functional groups because of the emphasis on intragroup competition, the absence of manifestly significant common goals, and the non-volitional aspects of membership. (See also PB 143 460)

Research Center for Group Dynamics, U. of Michigan, Ann Arbor.
STUDIES IN SELECTION LEARNING. I. THE EFFECT OF SELECTION PROCESSES ON ACQUISITION AND RETENTION, by Eugene Burnstein. Technical rept. no. 1 on Contract AF 49(638)367 and National Science Foundation Grant G-4951. Sep 59, 25p. 17 refs. AFOSR-TN-60-11.
Order from LC mi$2.70, ph$4.80 PB 145 101

The purpose of this study was to examine a type of learning called selection learning. It was hypothesized that there exist two factors in selection learning which cancel each other in acquisition, thus preventing differences in performance from appearing. One factor, facilitation of learning, was hypothesized to be a direct function of the informativeness of the selection cue. The other, interference with recall of international items was hypothesized to be a direct function of the informativeness of the selection cue. It was further hypothesized that the effects of interferences dissipate more rapidly than the effects of facilitation.

Research Center for Human Relations, New York U., N. Y.
STUDIES IN PRODUCTIVITY AND COHESIVENESS OF CULTURALLY MIXED GROUPS. II. EFFECTS OF VARIATIONS IN REWARD STRUCTURE, AUTHORITARIANISM, AND GROUP PRESTIGE, by Irwin Katz. Technical rept. no. 2 on Contract Nonr-285(24). Feb 59, 45p. 11 refs.
Order from LC mi$3.30, ph$7.80 PB 145 208

An experiment was performed in which bi-racial groups, consisting of two Negro college students and two white college students, were given a series of varied tasks to perform. Members of every group were matched on intelligence, informed of this fact, and caused to perform equally well on some cognitive tasks. As in a previous experiment, two types of Reward structure were created, Group Reward and Individual Reward, and also two conditions of Prestige, High Group Prestige and No Group Prestige. In addition, a new variable of Authoritarianism of white Ss was introduced by using high F-Scale scorers and low F-Scale scorers. Each experimental group was subjected to the same experimental treatment throughout its employment. Racial differences for all treatments combined indicated that Negroes oriented compliantly toward whites, felt intellectually inadequate, rejected whites as future work companions, and experienced less total satisfaction. Both the Reward variable and the Prestige variable had opposite effects on Negroes and whites. Negroes responded more favorably to Ind R and No P than to Grp R and Hi P, while whites responded more favorably to the latter conditions than to the former. Negroes were more ascendant with Hi F whites than with Lo F whites, and Hi F whites tended to be compliant in bi-racial situations but mutually antagonistic when paired alone. Numerous interactions of the F-Score variable with Reward and with Prestige revealed highly consistent patterns in which Hi F whites and Lo F whites responded in opposite ways to the experimental conditions.

Syracuse U., N. Y.
THE EFFECT OF NEED-ORIENTED COMMUNICATIONS ON ATTITUDE STRUCTURE AND CHANGE, by Francis J. Di Vesta and Jack C. Merwin. Rept. on Contract AF 41(657)73. June 58, 58p. 20 refs. WADC-TR-58-93; AD-151 044.
Order from LC mi$3.60, ph$9.30 PB 137 881

Several hypotheses, concerning attitude change and derived from a cognitive theory of attitude structure, were tested experimentally. The change procedure consisted of three tape recorded communications in which the positions were, respectively, that the attitude object facilitated, hindered, or had no effect on the satisfaction of the need for achievement. Scales of need strength, beliefs about the attitude object, and attitudes toward the attitude object were administered four months before, immediately before and/or immediately after the change procedure. Each of the two experimental groups and the control group was comprised of approximately 70 subjects. Changes in beliefs about the potentiality of the attitude object for satisfying the need for achievement corresponded to the position asserted by the respective communications. Corresponding changes in attitude were similarly demonstrated. An index based upon need strength and position of beliefs was found not to be related to change in attitude for the experimental groups but was significantly related to change in attitude occurring over a four months period. Significant relationships were found between initial position of attitudes and beliefs and the respective shifts in position. The findings were interpreted as supporting the cognitive theory of attitude structure. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
THE USE OF GROUP DECISION TO RESOLVE A PROBLEM OF FAIRNESS, by L. R. Hoffman and N. R. F. Maier. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Feb 59, 15p. 2 refs. 2144-351-T; AD-210 919.
Order from LC mi$2.40, ph$3.30 PB 144 697

An experiment is reported on the problem of fairly distributing a reward among group members. An empirical investigation was conducted of the use of the method of group decision in making such a distribution. Thirty groups, varying in size from 2 to 5, in an undergraduate psychology course were each assigned a number of points toward the final grade to be divided among their members, with a net loss to the group for failure to agree. In almost three-fourths of the groups, points were awarded to the members with the lower class standings. Variance of points awarded was positively correlated with variance of grade points in a group, and the number of points received was negatively correlated with grade points accumulated by an individual. Satisfaction with the decisions, which was high, was positively related to an individual's felt freedom to participate and to his satisfaction with influence over the decision. People who gave and received many points were also satisfied. Appointed leaders failed to function as leaders but participated more than other group members. Implications of the results for a practical industrial problem involving differential needs are discussed. (Author)

BIOLOGICAL SCIENCES

Anatomy and Physiology

[Aerospace] Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A PRELIMINARY REPORT OF HUMAN RESPONSE TO REARWARD-FACING RE-ENTRY ACCELERATIONS, by Neville P. Clarke, Alvin S. Hyde and others. Rept. on Acceleration in Flight. July 59, 19p. 6 refs. WADC Technical note 59-109.
Order from OTS $0.50 PB 161 438

Tidal volume, electrocardiographic changes, tracking performance ability, and subjective response were evaluated during an acceleration profile designed to encompass several possible rearward-facing reentry patterns. A maximum acceleration of 16.5 g and a total time of 170 seconds were employed. Subjects faced the center of rotation with the trunk and head inclined 12° in the direction of the centrifuge axis. The subjects were supported with a contoured net system. Two of seven subjects repeated the experiments wearing the MC-2 full pressure suit, both pressurized and unpressurized. (Author)

Aerospace Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
VENTILATORY RESPONSE TO FORWARD ACCELERATION, by Fred W. Zechman, Neil S. Cherniack and Alvin S. Hyde. Rept. on Biophysics of Acceleration. Sep 59, 21p. 16 refs. WADC Technical rept. 59-584.
Order from OTS $0.75 PB 161 427

This report presents the findings to two series of experiments dealing with the effect of forward acceleration on respiration in man. In the first, the effect of 5, 8, and 12 g on respiratory frequency, tidal volume, minute volume, and nitrogen elimination were determined. Frequency increased reaching an average of 39.2 cycles per minute and tidal volumes decreased to an average of 318 cc at 12 g. The volume of nitrogen eliminated during a 30 second period, breathing oxygen at 12 g, was essentially unchanged suggesting that gross alveolar ventilation did not decrease. In the second series, 0_2 consumptions were measured before, during, and after accelerations of 5, 8, 10, and 12 g. Oxygen consumptions increased with acceleration and it is presumed that the extra work of breathing may be an important contributing factor. In both series of studies the trunk was inclined 12° in the direction of acceleration and a rate of onset of 1 g per second was used. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ARCTIC SURVIVAL RATIONS, IV. ASSOCIATED EFFECTS OF DIET, ENVIRONMENTAL TEMPERATURE, AND DURATION OF EXPOSURE ON THE MAJOR CONSTITUENTS OF THE LIVERS OF RATS, by David A. Vaughan, John P. Hannon and Lucile N. Vaughan. Sep 59, 16p. 14 refs. Technical rept. 59-5.
Order from LC mi$2.40, ph$3.30 PB 144 850

The effects of feeding pemmican, and of exposure to an environment of 5° C. for periods of 1 month or 5 months, on the percentages of glycogen, total fat, phospholipid, protein, and water in the livers of rats were studied concomitantly. Cold exposure had the following significant effects: (1) a reduction in percentage of glycogen of both dietary groups, (2) a reduction in percentage of total fat of the pemmican group, (3) an increase in phospholipid (percentage of total fat) of both dietary groups, (4) an increase in percentage of water of both dietary groups. The ingestion of pemmican had the following significant effects: (1) a reduction in percentage of glycogen, (2) an increase in percentage of total fat, (3) an increase in phospholipid (percentage of total fat) at 27° C., (4) a decrease in percentage of water. A statistical analysis revealed that the effects of cold exposure and diet were to a certain extent interdependent, and that the duration of exposure modified the effects of both of these experimental treatments in several cases. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ARCTIC SURVIVAL RATIONS. VI: THE PHYSIOLOGICAL EFFECTS OF RESTRICTED DIETS DURING SUCCESSIVE WINTER FIELD TRIALS, by David A. Vaughan, Horace F. Drury and others. Aug 59, 27p. 12 refs. Technical rept. 58-8.
Order from LC mi$2.70, ph$4.80 PB 144 834

Two out of three different 1000 calorie combinations of pemmican and sugar were fed to each of 12 subjects during a two-phase, winter field study. All of the diets tested consisted primarily of pemmican, with the sugar contribution ranging from 0 to not more than 32% of the calories. The 5-day experimental phases were separated by a 7-day "recovery period." In the second period, the magnitude of all the above responses was strikingly reduced. The data suggest that the adaptation to caloric restriction which developed during the first period, as evidenced by sequential changes in blood sugar levels, nitrogen balance and ketone body excretion, persisted throughout the recovery period, permitting the subjects to respond more favorably to the second dietary stress.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
BLOOD CHEMISTRY OF THE COLD-ACCLIMATIZED RAT. I: PLASMA ELECTROLYTES, by John P. Hannon, Anna M. Larson, and David W. Young. Nov 59, 11p. 14 refs. Technical rept. 57-60.
Order from LC mi$2.40, ph$3.30 PB 144 843

Plasma from normal and cold-acclimatized (1 month at 5 ± 1° C.) rats were assayed for sodium, potassium, calcium, magnesium, chloride and phosphate. Acclimatization led to significant increases in sodium and magnesium levels but no changes in the other electrolyte studies. The physiological mechanisms behind these changes are discussed. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
EFFECT OF A LOW ENVIRONMENTAL TEMPERATURE ON WEIGHT AND FOOD CONSUMPTION OF THIAMINE-DEFICIENT RATS, by David A. Vaughan and Lucile N. Vaughan. June 58, 14p. 6 refs. Technical rept. 58-7; AD-227 508.
Order from LC mi$2.40, ph$3.30 PB 144 836

Fifty young adult rats (220-300 gm.) were divided into two groups. Twenty-five were subjected to moderately severe cold (5° C.); 25 were maintained at 25°C. Each group was divided into 5 subgroups, which received a thiamine-deficient diet for 18 days supplemented with the following levels of thiamine: 0.3 mcg./gm. diet, 0.4 mcg./gm., 0.5 mcg./gm., 0.6 mcg./gm., and 2.0 mcg./gm. Respective mean weight changes at these levels were: -69 gm., -55 gm., -51 gm., -18 gm., and +26 gm. for the cold rats; -89 gm., -71 gm., -49 gm., -37 gm., and +55 gm. for the rats held at 25° C. Corresponding mean voluntary food intakes for the 18-day period were 253, 299, 304, 351, and 436 gm. for the rats at 5° C. and 97, 100, 123, 143, and 284 gm. for the rats at 25° C. A statistical analysis indicated that there was no significant difference in weight response between the warm and cold rats at deficient levels of thiamine intake. The relation of weight changes to food intakes suggested that the cold rats used an approximately constant increment of food for their extra energy requirements in the cold. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE EFFECT OF TEMPERATURE ON THE HEART RATE, ELECTROCARDIOGRAM, AND CERTAIN MYOCARDIAL OXIDATIONS OF THE RAT, by John P. Hannon. Mar 58, 21p. 14 refs. Technical rept. 58-3; AD-220 761.
Order from LC mi$2.70, ph$4.80 PB 144 847

Deep hypothermia in the rat was characterized according to the sequential changes in body temperature, heart rate, and electrocardiogram. In vitro assays of myocardial metabolic activity were made at temperatures ranging from 5°C. to 35°C. These assays strongly suggested that the in vivo cardiac dysfunctions observed at low temperatures were attributable to shifts in temperature kinetics of enzyme systems at 20-21°C. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
GROSS LIVER COMPOSITION OF THE RAT FOLLOWING ONE-MONTH COLD EXPOSURE, by John P. Hannon and Lucile N. Vaughan. Sep 59, 13p. 17 refs. Technical rept. 58-26.
Order from LC mi$2.40, ph$3.30 PB 144 844

The total body weight, the liver weight, and the levels of water, protein, lipid, phospholipid, glycogen, and ash were assayed in male Sprague-Dawley rats exposed to either control conditions (26 ± 1° C.) or to cold (5 ± 1° C.) for 1 month. A statistically significant suppression of total body growth, but an augmentation of relative liver growth, was observed in the cold-exposed group. Cold also led to significant increases in the level of liver lipid and phospholipid, and a decrease in glycogen. No differences were observed in the protein, water, or ash content of the two groups. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
INFRARED EMISSIVITIES OF SOME ARCTIC

FAUNA, by H. T. Hammel. (Pennsulvania U. School of Medicine). May 57, 9p. 7 refs. Technical rept. 57-25; AD-220 677.
Order from LC mi$1.80, ph$1.80 PB 144 848

The infrared emissivities of the surfaces of ten arctic species were measured and found to be 1.0 for every species. The furs measured were winter pelts of the pine marten (Martes americana), sea otter (Enhydra lutris), beaver (Castor canadensis), red fox (Vulpes fulva), gray wolf (Canis lupus), lynx (Lynx canadensis), bobcat (Lynx rufus), snowshoe hare (Lepus americanus), barrenground caribou (Rangifer arcticus) and the winter plumage of the willow ptarmigan (Lagopus lagopus). The color of the surface for visible light, which may range from white to black, is no guide to the color in the far infrared at which wave lengths the surface is radiating energy to its environment. It seems likely that no arctic species has adapted to its radiation environment by acquiring a surface of low emissivity in the far infrared in order to reduce radiant heat loss to the cold sky. The same end would be achieved, however, if the animal were to shield itself from the sky. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE RESPIRATION OF RAT LIVER HOMOGENATES FOLLOWING PROLONGED COLD EXPOSURE, by John P. Hannon. Sep 59, 13p. 6 refs. Technical rept. 57-59; AD-228 411.
Order from LC mi$2.40, ph$3.30 PB 144 841

The respiration of liver homogenates derived from adult male rats exposed to cold for about 1 month was studied. Cold exposure led to increased rates when citrate, isocitrate, α-ketoglutarate, succinate, fumarate, malate, glutamate, and β-hydroxybutyrate were present as substrates. An increased endogenous metabolism was also found but no change in rate was observed when lactate was present as substrate. Differences were also found in both the magnitude and pattern of in vitro oxidations following cold exposure. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ROLE OF THE SYMPATHETIC NERVOUS SYSTEM IN THE CONTROL OF CHEMICAL REGULATION OF HEAT PRODUCTION, by A. C. L. Hsieh, L. D. Carlson, and G. Gray, (U. of Washington School of Medicine). Nov 59, 12p. 5 refs. Technical rept. 57-30; AD-228 548.
Order from LC mi$2.40, ph$3.30 PB 144 839

The ganglionic blocking agent hexamethonium chloride and the adrenolytic agent piperoxane hydrochloride prevented the increase in oxygen consumption otherwise observed in curarized, cold-adapted rats exposed to cold. Atropine sulfate had no effect. The sympathetic nervous system, including the adrenal medulla, appears to be important in the mediation of chemical regulation of heat production in these animals. L-noradrenaline was more effective than adrenaline in preventing the fall in oxygen consumption caused by hexamethonium. This finding suggests that noradrenaline may also play an important part in chemical regulation. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
SEASONAL AND RACIAL VARIATIONS IN HUMAN BLOOD ADENINE NUCLEOTIDE LEVELS, by John P. Hannon. Oct 59, 10p. 7 refs. Technical rept. 57-57.
Order from LC mi$1.80, ph$1.80 PB 144 838

This report presents the results of an observation of highly suggestive seasonal differences in blood chemistry.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THIAMINE LOAD TEST STUDIES IN HUMANS, by David A. Vaughan and Lucile N. Vaughan. Oct 59, 15p. 27 refs. Technical rept. 57-58.
Order from LC mi$2.40, ph$3.30 PB 144 837

The experiments reported here were of an exploratory nature. The first objective was to devise and test a liquid diet which was deficient in thiamine and in which the fat content could be varied isocalorically. Secondly, the diet was then used to determine whether a load dose return was affected by an extreme change in the fat content of the diet. Thirdly, the urinary excretion of thiamine during the oral ingestion of large amounts of thiamine was followed for an extended period.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
TRACKING PROFICIENCY AS A FUNCTION OF THERMAL BALANCE, by Robert B. Payne. May 59, 12p. 12 refs. Technical rept. 58-14; AD-220 763.
Order from LC mi$2.40, ph$3.30 PB 144 845

An experiment was conducted for the purpose of learning (a) whether performance decrement in monitoring and controlling a complex visual display is related to body heat loss, and (b) whether such an impairment can be forestalled by glycine administration. Following extensive training on the experimental task, 72 subjects were independently and randomly assigned to the nine combinations of three ambient temperature conditions (70°, 55°, and 40°F.) and three glycine treatments (0, 20, and 40 gms), then required to execute a performance sequence lasting three hours and twenty minutes. Statistical analyses established that the mathematical function relating performance to temperature was a parabola having a maximum near 55°. No significant glycine effects were observed. (Author)

Armed Forces-NRC Committee on Hearing and Bio-Acoustics, St. Louis, Mo.
CHABA ANNUAL REPORT NO. 4, by Hallowell Davis, Donald H. Eldredge, and J. Richardson Usher. Technical rept. no. 10, 1 June 56-31 May 57, on Contract Nonr-1151(01). June 57, 47p. 9 refs; AD-148 380.
Order from LC mi$3.30, ph$7.80 PB 138 235

The activities of the several Working Groups are summarized in the body of this report

Army Medical Research Lab., Fort Knox, Ky.
ANALYSIS OF COOLING UNDER CONDITIONS OF CHANGING AIR TEMPERATURE, by E. H. Wissler

and G. W. Molnar. Rept. on Environmental Physiology. 4 Apr 58, 21p. 5 refs. Rept. no. 295; AD-160 329.
Order from LC mi$2.70, ph$4.80 PB 144 953

By means of Duhamel's theorem and a Hankel transform an equation was derived for the cooling of an infinite cylinder under conditions of changing air temperature. The usefulness of the equation is restricted to specified conditions. It enables the utilization of data obtained under still air conditions. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
ACCELERATION PROBLEMS IN SPACE FLIGHT, by James D. Hardy, Carl C. Clark, and R. Flanagan Gray. Rept. no. 4 on Proj. [NM] 005.12-0005.6; Proj. TED ADC AE 1412. 1 Oct 59, 38p. 30 refs. NADC-MA-5909.
Order from LC mi$3.00, ph$6.30 PB 145 036

This paper describes the major problems associated with the effects of acceleration upon man and details the work which has already been done in this field on centrifuges, rocket sleds and other simulators. The problem of weightlessness is discussed with special reference to Gerathewohl's investigation of human tolerance to the weightless state produced during ballistic trajectory aircraft flights. A detailed account is given of advances in high G protection including the use of the contour couch and water immersion. Water immersion as a means of G protection is described with special emphasis on the recent investigations by Gray and Webb with the G capsule. In this total immersion capsule and with chest pressurization Gray in a record centrifuge run, recently withstood 31 G for 5 seconds with no lasting ill effects. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE ROLE OF SKIN IN HEAT TRANSFER, by Alice M. Stoll. Rept. no. 20 on Proj. NM 19 01 12.1, 16 Nov 59, 12p. 13 refs. NADC-MA-5918.
Order from LC mi$2.40, ph$3.30 PB 145 164

The dimensions and properties of human skin with respect to its role in heat transfer are summarized and discussed. (Author)

Biological Research Labs., Boston U., Mass.
VASOMOTOR ADJUSTMENTS IN THE MICROCIRCULATION DURING CHANGES IN BLOOD DISTRIBUTION, by George P. Fulton and Robert F. Slechta. Rept. for Jan 57-July 59 on Contract AF 49(638)44. [1959] 28p. 23 refs. AFOSR-TR-59-191.
Order from LC mi$2.70, ph$4.80 PB 144 789

This report describes the progress made on a research program in peripheral vascular responses to such blood-redistributing conditions as body orientation changes, corticosteroids and other substances produced during stress, temperature changes, hemorrhage, anoxia, etc.

Buffalo U., N. Y.
SOME PERCEPTUAL AND PHYSIOLOGICAL ASPECTS OF UNIFORM VISUAL STIMULATION, by Walter Cohen. Rept. for 31 Jan 58-31 Jan 59 on Contract DA 49-007-MD-866. [1959] 20p. 8 refs. AD-211 273.
Order from LC mi$2.40, ph$3.30 PB 144 807

The studies described in this report are concerned with the perception of objects in a uniform visual field. Three major problems were investigated. (A) The extent to which the accuracy of form recognition is dependent upon the structure of the visual field, the structure of the target, and prolonged exposure (90 sec.) to a uniform field. (B) The dependence of spatial orientation on field structure, characteristics of the target, and the subject's set. (C) The effects of prolonged exposure to the uniform field (20 min.) upon the "blank-out" (or "white-out") phenomenon, which involves a temporary cessation of vision. The chief findings were as follows: (a) Both uniformity of the field and prolonged exposure reduced the accuracy of recognition. However, their influence was found to vary with the complexity of the target. (b) Sensitivity to change in tilt was shown to be dependent upon the three variables listed above. An interaction effect among the three variables was found. (c) More frequent and more intensive "blank-outs" were reported with longer stimulation. Form recognition was seriously interfered with when "blank-out" occurred.

Chicago U., Ill.
A MATHEMATICAL INTERPRETATION OF MOTOR REACTIONS TO FIXED AND MOVING STIMULATION OF THE EYE, by M. Valentinuzzi. Rept. on Application of Information Theory to the Nervous System, Contract AF 18(600)1454. 25 Aug 58, 31p. 22 refs. AFOSR-TN-58-697; AD-162 231.
Order from LC mi$3.00, ph$6.30 PB 137 896

The results of experiments performed by L. S. Stone and by R. W. Sperry, on vision in salamanders are analyzed. A summary of Reichardt's theory, which originated in the researches of B. Hassenstein on insects, is given, and an application to salamanders is carried out. Introducing a simpler mathematical development based on the one-factor theory of excitation, the same formal results are obtained. A complete model, which includes those results and tries to fit the salamander behavior described by Stone, is elaborated and translated into boolean terms. As a complementary consideration it is pointed out that the functional rigidity of the visuomotor system, deriving from a biological molecular hysteresis, could be framed in the neuro-affinity principle, the spatial expression of which would turn out to be a biological field. (Author)

Gaustad Mental Hospital, Oslo (Norway).
AIRBORNE EEG RECORDING IN HIGH PERFORMANCE AIRCRAFT, by C. W. Sem-Jacobsen, O. Nilseng and others. Technical final rept. on Contract AF 61(514)1201. 28 Jan 59, 7p. 3 refs. AFOSR-TR-59-35; AD-213 038.
Order from LC mi$1.80, ph$1.80 PB 145 074

Thirty pilots performed 10 commonly flown maneu-

vers during which EEG recordings were made to determine whether the EEG was a suitable device for measuring physiological and psychological responses to flight stresses. The pilots were divided into 3 groups on the basis of the EEG records. Group A showed only minimal changes in response to the test flight. Group B showed marked high voltage changes of short duration in response to the same maneuvers. In the EEG's of the pilots belonging to group C gross changes of probably more pathological nature were seen. Out of the 30 pilots, 19 were in group A; 8 were in group B, and 3 in group C. After the test the pilots in group A appeared unaffected by the flight, kept good radio contact, were in good spirits, and reported no blackouts. The pilots of the B-group, on returning to the ground, perspired and appeared fatigued. They revealed blackouts and made mistakes in recollecting the flight. The pilots of group C were pale, perspired heavily, and had gone through episodes of loss of consciousness.

Pennsylvania U., University Park.
REGULATION OF FOOD INTAKE AND PHYSICAL ACTIVITY AND THE CONTROL OF OBESITY, by Albert Stunkard. Rept. for 1 Dec 57-30 Nov 58 on Contract DA 49-007-MD-925. [1958] 9p. 10 refs.
Order from LC mi$1.80, ph$1.80 PB 144 806

The present program represents a long-range combined psychological and physiological study of human obesity. During the past year the program has successfully negotiated the transfer to the University of Pennsylvania, a new research team has been recruited, new projects have been initiated and old ones continued, and the program is currently at its highest point of effectiveness and productivity. The underlying point of view of the program is that obesity results from a disordered energy regulation, a disorder which has its analogues in the disorders of energy regulation of the lower animals, but to which significant contribution is made by specifically human disturbances in communication and behavior. During the past year a variety of different points in the cycles of regulation have been studied, and further information has been accumulated as to where disorders may occur and where they definitely do not occur. The nature of the problems have, thus, been more clearly specified and beginnings have been made at their solution. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
NEUROPHYSIOLOGICAL REPRESENTATION OF COMPLEX AUDITORY STIMULI, by Moise H. Goldstein, Jr. Rept. on Contract DA 36-039-sc-64637. 19 Feb 57, 77p. 83 refs. Technical rept. 323; AD-156 530.
Order from LC mi$4.50, ph$12.30 PB 145 131

Neurophysiological representation of complex acoustic signals at the cochlea and cortex of the cat's auditory pathways was investigated. The signals were presented monoaurally and included repetitive bursts of noise, clicks, and bursts of tone; these are signals which human listeners judge to be of low pitch, although the concentration of energy is not in the low audio frequency range. Thresholds of cortical response were found to be independent of repetition rate. The tonotypic organization of the auditory cortex is related, primarily, to the distribution of stimulus energy in the spectrum. The temporal representation of envelope repetition rate was studied for stimuli at low and moderate intensity levels. The synchrony of cortical potentials is difficult to study by visual inspection, since the ongoing activity tends to observe small evoked responses. A synchrony to stimuli, with repetition rates up to 200/sec, in the cortical potentials from unanesthetized cats was detected by using an electronic processing device that averages a large number of responses. Evoked responses to stimuli with repetition rates up to 100/sec were detected in barbiturate-anesthetized cats. Psychophysical data on the discrimination of envelope repetition rate of modulated stimuli are also presented. A mathematical representation of signals as a function of variables related to spectral frequency and envelope periodicity is included.

University of Southern California. School of Medicine, Los Angeles.
PHYSIOLOGIC PRODUCTION OF CATECHOL AMINES IN RESPONSE TO SEVERAL PHYSICAL STRESSES, by John P. Meehan and Edith Jacobs. Rept. on Biophysics of the Cardiovascular System, Contract AF 33(616)5591. Sep 59, 24p. 17 refs. WADC Technical rept. 59-534.
Order from OTS $0.75 PB 161 441

Measurements of the physiologic production of adrenaline and noradrenaline in response to four standardized physical stresses were undertaken on young adult male subjects. Plasma levels of noradrenaline were found to increase significantly in exercise and the increase appears to bear a positive relationship to the physiologic severity of the exercise. Plasma levels of noradrenaline did not change as the result of the cold pressor test or as the result of exposure to positive accelerations of 3 g for 5 minutes. Renal plasma flow was not altered as the result of similar exposure to acceleration lasting for 10 minutes. (Author)

Vision Research Labs., U. of Michigan, Ann Arbor.
THE EFFECT OF FIXATION CONDITIONS ON DEPTH-DISCRIMINATION THRESHOLDS AT SCOTOPIC AND PHOTOPIC ILLUMINANCE LEVELS, by Alfred Lit. Rept. on Project Michigan, Contract [DA 36-039-sc-52654]. Nov 58, 16p. 8 refs. 2144-323-T; AD-206 347.
Order from LC mi$2.40, ph$3.30 PB 145 095

The precision of depth discrimination has been measured in a two-rod test apparatus involving real-depth cues. Effects due to different methods of fixating the rods have been assessed at each of a number of levels of equal illuminance presented to the two eyes. It was found that, for all three methods of fixation, the precision of depth discrimination increased by about 20:1 as the level of illuminance was increased over a range of some five log units. One method of fixation involved steady fixation on the movable comparison rod. A second method of fixation involved steady fixation on the immovable standard rod. In the third method of fixation, the observers were allowed to fixate on either of the rods at will. The precision of depth discrimination was clearly greatest with the

first method, at all but the very highest illuminance levels at which all three methods gave essentially equivalent results. The second method produced generally the lowest precision, whereas the third produced levels of precision generally intermediate between the other two. These results have a significance for photochemical theories of vision and for the current controversy concerning the role of convergence cues in stereoscopic acuity. (Author)

Visual Research Lab., Wellesley Coll., Mass.
SOME RELATIONSHIPS OF GLARE AND TARGET PERCEPTION, by Ernst Wolf and Michael J. Zigler. Rept. on Visual Presentation of Information, Contract AF 33(616)3305. Sep 59, 37p. 18 refs. WADC Technical rept. 59-394.
Order from OTS $1.00 PB 161 367

This study was carried out to describe quantitatively the relationship between the luminance of a glare source and threshold luminance of a test target when both are varied in angular subtense and distance from each other. The threshold visibility of a test target in the vicinity of a glare source was determined for various sizes and luminances of the glare source, various angular separations between glare source and target, and various exposure times and retinal locations. Thresholds for target perception become lower as glare luminance is decreased, area of glare source is decreased, distance between glare source and test target is increased, and size of test target is increased. When exposure time of the test target is increased, thresholds become lower until an exposure time of approximately one second is reached; longer exposure times have little effect on thresholds. When Landolt rings, letters, and dials are shown at various distances from a glare source, threshold luminance for readability similarly depends upon glare luminance and angular separation between glare source and target. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
LUMINOSITY FUNCTIONS OBTAINED WITH DIFFERENT METHODS AND DIFFERENT VIEWING CONDITIONS, by H. R. Blackwell and O. M. Blackwell. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Jan 59, 24p. 3 refs. Rept. no. 2144-344-T; AD-211 453.
Order from LC mi$2.70, ph$4.80 PB 144 733

A series of measurements of the human luminosity function made with a variety of methods, and under a variety of viewing conditions, is summarized. The luminosity function defines the effectiveness of various wavelengths of visible radiation in eliciting the brightness response. Methodological variants which were studied include: (a) the method used to arrive at the brightness equation; (b) the number and spectral composition of the standard radiances used; (c) the configuration of the field of the photometric comparator; and (d) the use of direct heterochromatic comparison versus the use of flicker photometry. Luminosity functions were measured by a standard procedure for 1^{o} and 3^{o} comparison fields, and at 4 levels of retinal illuminance from 0.0894 to 304 trolands. The luminosity data obtained were found to agree exceptionally well with the 1931 and 1951 CIE photopic luminosity functions from 520 to 700 mμ. However, at wavelengths below 520 mμ, the luminosity coefficients obtained are considerably higher than even the 1951 CIE values, which are themselves considerably higher than the 1931 CIE values.

Biochemistry

Army Medical Research Lab., Fort Knox, Ky.
THE ROLE OF PLASMA ACCELERATOR-GLOBULIN AND ITS THROMBIN ACTIVATED FORM, SERUM ACCELERATOR-GLOBULIN, IN THE CONVERSION OF PROTHROMBIN, by Betty R. Johnston and H. Jensen. 3 Mar 58, 22p. 27 refs. Rept. no. 329; AD-153 646.
Order from LC mi$2.70, ph$4.80 PB 138 334

Either plasma accelerator-globulin or serum accelerator-globulin must be present in order to obtain complete conversion of prothrombin in the presence of serum-eluate factor (s) [proconvertin or plasma thromboplastin component or both], antihemophilic factor, platelet factor 3, and calcium ions. If plasma accelerator-globulin is present, it must be converted to serum accelerator-globulin by the action of thrombin before the maximum rate of prothrombin conversion is reached. Serum accelerator-globulin does neither affect the degree nor the rate of interaction of serum-eluate factor(s), antihemophilic factor, platelet factor 3, and calcium ions forming a prothrombin-conversion factor but affects thrombin formation at a point just prior to or during the conversion of prothrombin.

Nutritional Research Lab., St. Luke's Hospital, New York.
AMINO ACID METABOLISM OF MAN IN HEALTH AND DISEASE, by Anthony A. Albanese. Annual progress rept. for 1 Jan-31 Dec 57 on Contract Nonr-1167(00). 15 Dec 57, 12p. 15 refs. AD-150 041.
Order from LC mi$2.40, ph$3.30 PB 138 204

In metabolically normal older convalescents, the consumption of at least 1.5 g of protein per kilo per day, with 30% in the form of meat, speeded tissue regeneration. Consecutive week-long N balance studies with placebo, a supplement containing methionine, threonine, valine and isoleucine (MTVI), a supplement containing MTVI and lysine (MTVIL), and again MTVI, were conducted on 26 adult females (31 to 92 yr). The balance N of 8 subjects was improved during the administration of MTVIL. Increases in N balance were also obtained with steroids. A technique was developed for detecting functional defects in peptic digestion. Observations suggested that greater protein utilization was achieved as the calorie distribution of the supplement approached the ideal ratio (protein 15%, carbohydrates 50% and fats 35%). Plasma amino N levels appeared to constitute a valuable adjunct to differentiate between maximal and submaximal positive N balance states in depleted individuals. Study of enzymatic techniques was initiated to measure the nutritive value of proteins as they occur in common foods.

Washington State Coll. [Pullman].
ENZYMATIC STUDIES ON THERMOPHILIC BACTERIA, by L. Leon Campbell, Jr. Final rept. for 1 Feb 56-31 Jan 59 on Contract Nonr-1856(00). [1959] 12p. 2 refs.
Order from LC mi$2.40, ph$3.30 PB 144 745

Results are summarized on: Studies on alpha-emylase of Bacillus stearothermophilus: amylase yields by different cultural methods, preparation of crystalline enzyme; optimum pH and temperature for dextrinogenic activity of alpha-amylase; effect of enzyme and substrate concentration on activity; effect of calcium on enzyme activity; effect of urea, guanidine, N-ethylmaleimide and p-hydroxymercuribenzoate on enzyme activity; determination of free sulfhydryl groups in the enzyme; thermal stability of the enzyme; ultraviolet absorption spectrum of crystalline amylase; amino acid analysis of the enzyme; dye binding capacity of the enzyme and titration data; optical rotatory properties of the enzyme; physical constants of the enzyme; effect of performic acid oxidation on enzyme activity; Proteinase of Bacillus stearothermophilus; Amino acid deaminases and amino acid amide deamidases of bacillus coagulans and Bacillus stearothermophilus; Glucose and pyruvate metabolism of Bacillus coagulans.

General Biology

Arctic Aeromedical Lab., Ladd AFB, Alaska.
SIMPLIFIED APPARATUS AND METHODS FOR THE WET ASHING OF LARGE NUMBERS OF BIOLOGICAL SAMPLES, by John P. Hannon. Aug 59, 14p. 1 ref. Technical rept. 57-56.
Order from LC mi$2.40, ph$3.30 PB 144 835

Apparatus and techniques described in this report were developed. These include: construction of a simple 14-unit digestion apparatus that takes up approximately the same space that 6-unit commercial models occupy and yet costs only a fraction as much; racks for holding and segregating the large numbers of kjeldahl digestion flasks finally, a technique for the calibration of kjeldahl flasks so that the digestions and dilutions preparatory to making the desired assay can be carried out in the same flask. Thus, where space is limited, the large capacity of this digestion apparatus, the sulfuric acid-hydrogen peroxide digestion procedure which is described, and the conventional nesslerization method for determining nitrogen will greatly increase the capacity of the laboratory to carry out tissue digestions.

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 1. MEDICAL BIOLOGICAL, SOCIAL AND BEHAVIORAL SCIENCES. 366p.
Order from OTS $3.75 PB 161 133

Contents:
Medical Sciences:
Basic medical sciences
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(See also PB 151 494)

Pacific Science Board, National Research Council, Washington, D. C.
ATOLL RESEARCH BULLETIN NOS. 59-60. Rept. on Contract N7onr-29154. 31 Oct 57, 279p. 47 refs. AD-152 999.
Order from LC mi$11.10, ph$42.60 PB 137 948

Contents:
Bull. 59. The Gilbert Islands; Some Aspects of Human Ecology, by René L. A. Catala.
Bull. 60. Climate and Meteorology of the Gilbert Islands, by Marie-Hélène Sachet.
(See also PB 128 595)

Microbiology

[Bureau of Labs.] Florida State Board of Health, Jacksonville.
THE RELATIVE EFFICACY OF CULTURE MEDIA FOR THE ISOLATION OF MYCOBACTERIUM TUBERCULOSIS FROM CLINICAL MATERIAL, by Mildred B. Jefferies, Albert V. Hardy, and Nathan J. Schneider. Sep 59, 9 refs. AFSAM rept. 59-94.
Order from LC mi$1.80, ph$1.80 PB 145 103

The relative efficacy of Lowenstein-Jensen medium, penicillin blood agar, American Trudeau Society medium, Difco Peizer TB medium, Middlebrook 7H9 agar A, and a semi-synthetic autoclavable medium for the isolation of Myco. tuberculosis from specimens submitted to a public health laboratory has been compared. Lowenstein-Jensen was the most sensitive of the media tested though the difference in positive isolations on this and on the American Trudeau Society medium was not statistically significant. In our hands, the others were less effective and in some respects more difficult to use. A third slant increased only slightly the proportion of positive findings. The use of two slants with large areas for inoculation appears to be an acceptable technic and this is practicable for laboratories handling large numbers of specimens. (Author)

Bureau of Labs., Florida State Board of Health, Jacksonville.
A STUDY OF THE NEUTRAL RED TEST FOR THE DETERMINATION OF THE VIRULENCE OF MYCOBACTERIA, by Mildred B. Jefferies, N. J. Schneider, and A. V. Hardy. Sep 59, 4p. 6 refs. AFSAM rept. no. 59-54.
Order from LC mi$1.80, ph$1.80 PB 145 098

Two hundred fifty-three acid-fast strains of mycobacteria were tested for virulence by inoculating guinea pigs and comparing the results with those obtained in the neutral red test. In 80.9 percent of the strains tested, test results showed agreement. In 19.0 percent of the strains tested the results were not in agreement. Some of the factors which may have influenced the results are discussed.

Pathology

Arctic Aeromedical Lab., Ladd AFB, Alaska.
DEVELOPMENT OF MICROSTRUCTURE OF ALASKAN ESKIMO TOOTH SAMPLES, by Gisle Bang. 15 May 58, 13p. 15 refs. Technical rept. 58-20.
Order from LC mi$2.40, ph$3.30 PB 144 833

The present study deals with the microstructure of teeth from contemporary Alaskan Eskimos, which do not appear to have been studied histologically before. In addition to teeth from contemporary individuals with and without caries, the study includes teeth obtained from skulls of Alaskan Eskimos prior to their contact with western civilization.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE GROWTH OF HUMAN TUMORS IN THE HIBERNATING HAMSTER, by W. Bradford Patterson, Charles P. Layman, and Helen P. Patterson (Harvard Medical School). Oct 59, 9p. 13 refs. Technical rept. 57-18.
Order from LC mi$1.80, ph$1.80 PB 144 840

Four human transplantable tumors have been grown in hibernating hamsters. One human tumor strain failed to grow. During hibernation, tumor growth was markedly inhibited, but resumed its normal rate when animals were returned to warm room temperatures. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
PRODUCTION OF PAIN AND THERMAL BURNS IN SKIN AREAS PREVIOUSLY EXPOSED TO ULTRAVIOLET RADIATION, by Alice M. Stoll, Leon C. Greene, and James D. Hardy. Rept. no. 19 on Proj. NM 10 01 12.1. 21 Sep 59, 13p. 14 refs. NADC-MA-5915; AD-226 918.
Order from LC mi$2.40, ph$3.30 PB 144 676

In order to evaluate the relationship of tissue damage to pain sensation in areas of hyperalgesia, the skin of three subjects was irradiated with erythemal doses of ultraviolet radiation and then exposed to thermal radiation. Measurements were made of the pain threshold lowering effect of the ultraviolet radiation and, following the development of the hyperalgesia, of the lowering of the blister threshold to thermal radiation. Lowering of the pain threshold of 4-7°C was observed, while the lowering of the blister threshold (i.e., the temperature at which blistering was produced) was of the order of 0.5°C. The ultraviolet-irradiated hyperalgesic skin is therefore not more fragile as regards moderately high temperature (50°C) and high temperature burns than is normal undamaged skin. This finding is in keeping with the previously proposed theory that the intensity of pain is a function of the relative reaction rates at the thermal threshold and at skin temperatures above this threshold. Theory predicts, however, that ultraviolet irradiated skin heated to, and maintained at, relatively low temperatures (40-45°C) will be more easily blistered than will undamaged skin. This possibility has not been investigated as yet. The promising possibility of testing the analgetic action of the weak analgesics, such as the salycilates by experimental procedures in areas of induced hyperalgesia is noted. (Author)

Psychological Research Associates, Inc., Arlington, Va.
ANALYSIS OF DATA ON THE SURVEY OF THE DENTAL HEALTH OF THE NAVAL RECRUIT, by Ray C. Hackman and John A. Lesser, Jr. Rept. on Contract Nonr-2362(00). Jan 58, 22p. 1 ref. PRA Rept. 58-5.
Order from LC mi$2.70, ph$4.80 PB 138 335

This report summarizes analyses made of the relationships between measures of dental health and/or state and certain personal, demographic, and attitudinal variables that characterize the naval recruit. Some fifteen measures of dental health or state were examined.

Wisconsin U. School of Medicine, Madison.
PREVENTION AND TREATMENT OF VENTRICULAR FIBRILLATION IN HYPOTHERMIA, by John E. Steinhaus and Karl L. Siebecker. Apr 58, 12p. 8 refs. Arctic Aeromedical Lab. technical rept. no. 58-5; AD-227 657.
Order from LC mi$2.40, ph$3.30 PB 145 092

The treatment of heart failure produced by body cooling was studied. The role of CO_2 in onset of ventricular fibrillation was studied, and the results suggest that this physiological variable may be a less important factor than has been previously indicated. Increased CO_2 levels made resuscitation less difficult. An investigation of various anesthetic agents at 27°C. hypothermia revealed an absence of ventricular fibrillation, despite the long periods of hypercarbia and hypoxia. (Author)

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EFFECT OF EA 1476 ON SWIMMING TIME

IN GUINEA PIGS, by Charles G. Wilber and Roy E. Crawford. Sep 59, 7p. 3 refs. CWLR-2308.
Order from LC mi$1.80, ph$1.80 PB 145 137

The effect of EA 1476 on swimming time in guinea pigs was ascertained. The swimming time of guinea pigs in a bath at 28°C was decreased to approximately 74 per cent of controls after treatment with EA 1476 in a dose of 1 mg/kg. Guinea pigs which had been accustomized to swimming, by repeated training sessions, swam longer and showed less variability than untrained animals. (Author)

[Army Chemical Warfare Labs.] Army Chemical Center, Md.
THE INHALATION TOXICITY OF SESQUI-MUSTARD (Q) AEROSOL IN MICE, RATS, GUINEA PIGS, HAMSTERS, PIGEONS, AND DOGS, by F. J. Vocci, C. L. Punte, Jr., and others. Sep 55, declassified 18 Sep 58, 45p. 24 refs. Medical Labs. Research rept. no. 403.
Order from LC mi$3.30, ph$7.80 PB 144 679

The inhalation toxicity of Q aerosol in mice, rats, guinea pigs, hamsters, pigeons and dogs exposed for a period of 2 or 10 minutes based on a 14 day observation period is summarized in the following table:

Species	LCt50(t = 2 min.) mg. min. /m. 3	LCt50 (t = 10 min.) mg. min. /m. 3
Mice	72 (53 - 85)	63 (40-82)
Rats	133 (114-154)	109 (74-183)
Guinea Pigs	220 (140-470)	83 (63-117)
Hamsters	274 (262-282)	220
Pigeons	---	---
Dogs	180	

[Army Chemical Warfare Labs.] Army Chemical Center, Md.
THE MEDIAN DETECTABLE CONCENTRATION OF DIBORANE, PENTABORANE AND DECABORANE BY ODOR FOR MAN, by Charles C. Comstock and Fred W. Oberst. Aug 53, 9p. 4 refs. Research rept. no. 206; AD-16 993.
Order from LC mi$1.80, ph$1.80 PB 144 667

The median detectable concentrations (MDC's) of 3 boron hydrides were determined with a Fair-Wells osmoscope. Each compound was tested 2 to 4 times on 10 to 15 subjects. The MDC's of diborane (B_2H_6), pentaborane (B_5H_9), and decaborane ($B_{10}H_{14}$) were 3.7, 2.5, and 0.35 mg/cu m, respectively. The prescribed chamber concentration of B_2H_6 was determined by an analytical procedure, whereas the concentrations of B_5H_9 and $B_{10}H_{14}$ were determined by nominal methods. The B_2H_6 was described as having an odor of rotton eggs; B_5H_9, as either garlic, acetylene-like, or slightly sweet; and $B_{10}H_{14}$, either unpleasant, foul, or chocolate-like. No aftereffects occurred from any of the vapors in concentrations of 0.2 to 6 mg/cu m.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE PROPHYLACTIC AND THERAPEUTIC EFFECTIVENESS OF DAM (2, 3-BUTANEDIONE 2-OXIME) IN RATS POISONED BY GB VAPOR, by Fred W. Oberst, Carl W. Umland, Jr. and others. Sep 59, 22p. 11 refs. CWLR-2305.
Order from LC mi$2.40, ph$3.30 PB 144 711

The work reported was designed to determine some of the factors limiting the prophylactic and therapeutic effectiveness of 2, 3-butanedione 2-oxime (DAM) in protecting rats against the toxic action of inhaled GB vapor. It was concluded that DAM administered intraperitoneally 5 min to 4 hr prior to GB vapor exposure by inhalation is an effective prophylactic agent for rats. Its effectiveness depends on the dose of DAM, the time of its administration before exposure to GB vapor, the concentration of GB vapor, and the length of time of a GB exposure. In contrast with its prophylactic effectiveness, DAM is less effective as a therapeutic agent when administered intraperitoneally to rats immediately after a 30-sec lethal exposure. (Author)

CHEMISTRY

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 2. CHEMISTRY. 365p.
Order from OTS $3.75 PB 161 134

Contents:
Analytical chemistry
Biochemistry
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Organic chemistry
Physical chemistry, colloids
Physical chemistry, general and nuclear
(See also PB 151 495)

North Carolina U., Chapel Hill.
THE CHELON APPROACH TO ANALYSIS, by Charles N. Reilley, R. W. Schmid and Fawzy S. Sadek. UNC-Chem. no. 1 on Contract AF 49(638)333. 29 Aug 59, 56p. 41 refs. AFOSR-TN-59-[896].
Order from LC mi$3.60, ph$9.30 PB 144 879

The introduction of chelons such as EDTA has virtually revolutionized the analytical approach to the metal ion analysis. This approach commenced with the classical work of Schwarzenbach on the volumetric determination of calcium and magnesium—a procedure which was rapidly and universally adopted for estimation of water hardness. Since then the applicability of the EDTA methods has been extended to the determination of over 50 elements and its scope will undoubtedly be broadened even further. Because of the present wide applicability of the chelon approach and because of its unusual future possibilities, this brief and introductory status report is given to acquaint chemists with this approach and to present some material suitable in inorganic research and in analytical courses in summary form. (Author)

Pennsalt Chemicals Corp., Wyndmoor, Pa.
RESEARCH IN THE BROAD FIELD OF SYNTHESIS AND CHARACTERIZATION OF INORGANIC COMPOUNDS AND MATERIALS, by A. Kowalski, F. D. Loomis and others. Technical rept. no. 1, 15 Sep 58-15 Mar 59, on Contract Nonr-2687(00). [1959] 78p. 80 refs.
Order from LC mi$4.50, ph$12.30 PB 145 349

A large number of coordination compounds of chromium, cobalt, platinum and zinc were prepared as potential monomers. In many instances, synthesis procedures reported in the literature could not be duplicated. Polymerization of these monomers is now under investigation. Polymeric $[Zn(NH_3)Cl_2]_x$, which softens at 100°C., was discovered to be capable of being drawn into flexible fibers that retain plasticity under anhydrous conditions. This polymer, which shows excellent bonding strength to glass, will withstand temperatures up to 425°C. for 1.5 hours. Attempts to link 1, 3, 5-triazine rings by means of polyfunctional catenating agents were initiated. A series of novel triazine polymers incorporating sulfamide has been synthesized, some of which could be pressed to transparent films. New methods for synthesizing unusual linking agents such as sulfuryl and thionyl isocyanates and some related phosphorus derivatives were investigated. Experiments were initiated on modification of a number of silicates by interstitial cation substitution, anion replacement and isostructural substitution. Analogous work on fluoaluminates was initially limited to cation substitution.

Washington U., Seattle.
THE REACTION OF BROMINE TRIFLUORIDE AND FLUORINE TO BROMINE PENTAFLUORIDE, by Harris E. Kluksdahl and George H. Cady. Technical rept. no. 21 on Contract Nonr-477(16). 1959, 14p. 14 refs.
Order from LC mi$2.40, ph$3.30 PB 144 898

The kinetics of the gas phase reaction of bromine trifluoride and fluorine to form bromine pentafluoride have been studied from 68 to 121° C in a nickel reactor and with the initial pressures varying from 30 to 300 mm. The reaction was found to be bimolecular, homogeneous, and to have an activation energy of 16.4 kcal. The observed frequency factor of 2.6 x 10" cc. mole sec. corresponded to a probability factor of 10^{-3}, thus indicating that every bimolecular collision was not effective in producing bromine pentafluoride. The loss of three rotational and two vibrational degrees of freedom indicates that energy transformations have to be made in several degrees of freedom in formation of the activated complex, and this very likely accounts for the slowness of the reaction. Evidence was found suggesting that bromine trifluoride is partially associated in the vapor phase. (Author)

Birkbeck Coll. (Gt. Brit.)
ALKYL AND ARYL DERIVATIVES OF THE PHOSPHONITRILIC HALIDES, by R. A. Shaw. Annual technical status rept. no. 1, 1 Oct 58-30 Sep 59, on Contract DA 91-508-EUC-363. 10 Nov 59, 71p. 13 refs.
Order from LC mi$4.50, ph$12.30 PB 145 348

This report covers the first year's work on alkyl and aryl derivatives of the phosphonitrilic halides. The most striking progress was made in the work on the phenylation of the trimeric chloride, $P_3N_3Cl_6$, under FRIEDEL-CRAFT'S conditions. Different catalysts have been examined and so far aluminium chloride has been found to be the most successful. Many compounds and polymers are described and discussed.

Chemical Lab., U. of Kansas, Lawrence.
REDUCTION OF ORGANIC COMPOUNDS BY LOWER VALENT SPECIES OF ACTIVE METALS, by William E. McEwen and Jacob Kleinberg. Technical rept. no. 10, 1 Aug 58-1 Jan 59, on Contract DA 23-072-ORD-1048. [1959] 15p. 23 refs. OOR rept. 873.10-C.
Order from LC mi$2.40, ph$3.30 PB 145 173

The anodic oxidation of aluminum in pyridine solutions of sodium iodide or lithium chloride in the presence of benzophenone gives initial mean valence numbers significantly lower than 3. Reduction products, namely benzhydrol and benzopinacol, are isolated from the anolyte hydrolysate in amounts corresponding to oxidation of aluminum from its measured initial mean valence state to the familiar tripositive state. The ratio of the two reduction products shows a dependence on the nature of the cation of the electrolyte. The same reduction products are obtained from the catholyte hydrolysate when lithium chloride is used as electrolyte and aluminum as cathode. Mechanisms are proposed to account for both anolyte and catholyte products. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
THE HEAT OF POLYMERIZATION OF PHENYL GLYCIDYL ETHER AND OF AN EPOXY RESIN. PART II. EFFECT OF ALCOHOL ON THE POLYMERIZATION, by C. H. Klute and B. W. Shellenbarger. 9 Nov 59, 7p. 3 refs. Technical rept. TR-791.
Order from LC mi$1.80, ph$1.80 PB 144 758

In a previous report the heats of polymerization of phenyl glycidyl ether were compared with those of an epoxy resin for a variety of polymerization catalysis. In those experiments 20 parts by weight of ethylene glycol per 100 parts of phenyl glycidyl ether were added to the ether to serve as a cocatalyst. In the present report it is demonstrated that, when lesser amounts of alcohol are used, the measured heats of polymerization are not significantly different from the values obtained earlier. (Author)

Iowa State [U. of Science and Tech.] Ames.
ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH-TEMPERATURE LUBRICANTS AND RELATED MATERIALS, by Henry Gilman and Richard D. Gorsich. Rept. on Rubber, Plastic, and Composite Materials, Contract AF 33(616)3510. May 57, 63p. 26 refs. WADC Technical rept. 53-426, Pt. 4; AD-118 307.
Order from OTS $1.75 PB 131 176

This project is concerned primarily with the synthesis of new compounds to be examined as potential hydraulic fluids and lubricants. The synthesis and preliminary screening of organo-metallic and organo metalloidal compounds has been extended. New cyclic compounds continue to be promising. It has also been found that the meta-biphenylyl group can be added to those groups which impart desirable physical characteristics. The methyl-dibenzylsilylmethyl group is also of significant promise. In the experimental part, there is included a table which outlines the preliminary screening of thirty-six compounds. (Author). (See also PB 111 889)

Istituto di Chimica Industriale, Universitá Bologna (Italy).
EXPERIMENTAL AND THEORETICAL STUDY OF THE CONJUGATION IN AROMATIC COMPOUNDS WITH PARTICULAR EMPHASIS ON: 1. SUBSTITUTED DIARYL SELENIDES. 2. DISUBSTITUTED THIOPHENE DERIVATIVES. 3. THEORETICAL CORRELATION OF THE EXPERIMENTAL RESULTS, by Angelo Mangini. Final technical rept. for 1 Oct 58-Oct 59 on Contract DA 91-591-EUC-883. Oct 59, 151p. 40 refs. AD-228 535.
Order from LC mi$7.50, ph$24.30 PB 144 912

Seleno-derivatives: Seleno-derivatives, many not yet described in the chemical literature, were prepared; the preparation and purification of these compounds are very difficult because of their low yield and the separation of metallic selenium. A comparison of the electronic spectra of some suitable seleno compounds indicated that the selenium of selenides, like the sulphur of sulphides, does not expand its valence shell, neither as electron-acceptor nor as electron-acceptor-donor. Thiophene derivatives: Thiophene derivatives, phenyl-thiophenes, diphenyl-thiophenes, and thienyl-ketones, with some benzyl-thiophenes, were prepared through a series of intermediates. Many of these derivatives are new compounds. The electronic spectra were recorded in aprotic solvents. Results indicated (1) a stronger resonance effect of the substituent in the α position than in the β position; (2) the α-phenyl-thiophene is quite comparable to diphenyl; (3) a noticeable steric effect in 3, 4-diphenyl-thiophenes, contrary to the 2-thienyl-ortho substituted phenyl-ketones (ortho substituent being the methyl group or bromine); and (4) the electron donor power of the sulphur of thiophene is greater than the oxygen of furan. A study of the UV spectra of thiophene derivatives indicated that expansion of the valence shell of the sulphur of thiophene appears improbable.

Massachusetts U., Amherst.
O-ACYLHYDROXYLAMINES. II. O-MESITYLENESULFONYL, O-p-TOLUENESULFONYL- AND O-MESITOYLHYDROXYLAMINE, by Louis A. Carpino. Rept. on Contract AF 18(603)114. Oct 59, 12p. 8 refs. AFOSR-TN-59-1242.
Order from LC mi$2.40, ph$3.30 PB 144 962

O-Mesitylenesulfonyl- and O-p-toluenesulfonylhydroxylamine have been prepared by the hydrofluoric acid and perchloric acid cleavages of the corresponding t-butyl N-arenesulfonoxycarbamates. The structures of the O-arenesulfonylhydroxylamines were established by (a) iodometric analysis, (b) reaction with acetone which gave the corresponding O-sulfonylacetoximes and (c) infrared examination. O-Mesitoylhydroxylamine was prepared similarly from t-butyl N-mesitoyloxycarbamate. Reaction of O-mesitoylhydroxylamine with dibenzylamine gave 1, 1-dibenzylhydrazine. (Author)

Mellon Inst. [of Industrial Research, U. of Pittsburgh] Pa.
STEREOSPECIFICITY IN THE FREE RADICAL POLYMERIZATION OF VINYL ACETATE (PART I). SYNTHESIS OF MODEL BRANCHED POLYMERS (PART II). THERMALLY STABLE POLYMERS CONTAINING THE TRIAZINE RING (PART III). MODELS OF STEREOREGULAR POLYMERS (PART IV) by Barbara Botelec, T. G. Fox and others. Technical rept. no. 1 on Contract Nonr-2693(00). 28 Feb 59, 85p. 12 refs.
Order from LC mi$4.80, ph$13.80 PB 144 900

Rochester U., N. Y.
PHOTOISOMERISATION PROCESSES IN CYCLIC KETONES I. CYCLOPENTANONE AND CYCLOPENTANONE (2,2,5,5,-D4), by R. Srinivasan. Rept. on Contract AF 18(600)1528. 25 Nov 58, 14 refs. AFOSR-TN-58-998; AD-206 141.
Order from LC mi$2.40, ph$3.30 PB 138 145

4-pentenal has been identified as one of the products of the vapor phase photolysis of cyclopentanone at 3130A. Quantum yields for the formation of 4-pentenal have been obtained at various temperatures and in the presence of added oxygen and carbon dioxide. The photolysis of cyclopentanone (2,2,5,5 -D_4) has been found to give tetradeutero 4-pentenal the structure of which is most probably $CD_2 = CHCH_2CD_2CHO$. On the basis of these results, it is deduced that the photoisomerization of cyclopentanone to 4-pentenal involves a direct transfer of a hydrogen atom from a β-carbon to the carbonyl group in an excited state of the ketone molecule. (Author)

Technical Operations, Inc., Burlington, Mass.
THE CHEMISTRY OF QUINONE, by James E. LuValle, Gershon M. Goldberg and others. Technical note on Contract AF 18(600)371. 15 Aug 58, 73p. 53 refs. Rept. no. TOI 58-29; AFOSR-TN-58-774; AD-201 777.
Order from LC mi$4.50, ph$12.30 PB 137 874

The chemistry of p-benzoquinone has been examined in detail. Of particular interest were the transitory colored intermediates observed in the early stages of some of the known reactions of quinone and the monomeric products thought to be formed on alkaline decomposition of quinone. Hydroxyhydroquinone, hydroxyquinone and 2, 5-dihydroxyquinone were synthesized and their reactions were extensively investigated. It appears likely that a path of decomposition of quinone proceeds through the intermediates hydroxyhydroquinone, hydroxyquinone and dihydroxyhydroquinone to dihydroxyquinone. No evidence for the dismutation of quinone or hydroxyquinone was found. Observations on the behavior of quinone in acid and alkaline solutions led to the formulation of two general mechanisms useful for the explanation of the reactions of quinone in solution. A series of ionic and free radical intermediates formed from quinone are capable of adding ions from solution to form the monomeric reaction products or of adding to other quinone molecules to form the polymeric humic acids. The extreme reactivity of quinone appears to arise as a result of the facile opening of its carbonyl bonds by either acidic or basic reagents. (Author)

Physical Chemistry

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
THE MECHANISM OF POLYTETRAFLUOROETHYLENE PRYOLYSIS, by Henry Friedman. Rept. on Contract AF 04(647)269. 19 June 59, 28p. 26 refs. Technical Information Series R59SD385; Aerophysics Research Memo 37.
Order from LC mi$2. 70, ph$4. 80 PB 145 182

New kinetic equations for polymer chain degradation were used to examine the polytetrafluoroethylene pyrolysis mechanism. Observations made during polytetrafluoroethylene pyrolysis, which were not readily explained by previously postulated mechanisms, were accounted for by the present mechanism.

Bureau of Mines, Bartlesville, Okla.
THERMOCHEMISTRY AND VAPOR PRESSURE OF ALIPHATIC FLUOROCARBONS. A COMPARISON OF THE C-F AND C-H THERMOCHEMICAL BOND ENERGIES, by W. D. Good, D. R. Douslin and others. Technical note on Contract CSO 680-57-4. 3 Nov 58, 28p. 15 refs. AFOSR-TN-58-976; AD-205 856.
Order from LC mi$2. 70, ph$4. 80 PB 137 848

The heat of formation of four organic fluorine compounds, including three completely fluorinated aliphatic compounds, was determined by a rotating-bomb method of combustion calorimetry. An earlier technique that used sealed, fused-quartz ampoules for containing samples of volatile fluorine compounds was replaced by an improved technique that used sealed bags of a polyester film.

California U., Berkeley.
THE INFRARED DETECTION OF THE FORMYL RADICAL, HCO, by George E. Ewing, Warren E. Thompson, and George C. Pimentel. Rept. on Contract AF 49(638)1. 9 Nov 59, 18p. 22 refs. AFOSR-TN-59-1197.
Order from LC mi$2. 40, ph$3. 30 PB 144 866

The photolysis of HI, DI, HBr, and DBr suspended in solid CO at 20°K is described. The formyl radical, HCO or DCO, is produced, as shown by broad absorptions in the visible spectral region (6695, 6352, 6052, 5789, 5548, 5330, 5102 A) which correspond to absorptions of gaseous HCO. Infrared absorptions of HCO (at 1860 and 1091 cm^{-1}) and of DCO (at 1860 and 856 cm^{-1}) provide a basis for discussing the chemical bonding of this free radical and for calculating its thermodynamic properties. These experiments, the first infrared detection of a triatomic free radical by the matrix isolation method, depend upon reactivity of the matrix, possibly eliminating difficulties of the cage effect. (Author)

Central Inst. for Industrial Research (Norway).
OXIDATION OF NIOBIUM, by Tor Hurlen, Hallstein Kjøllesdal and others. Technical scientific note no. 1 on Contract AF 61(052)90. Apr 59, 126p. 75 refs. AD-225 549.
Order from LC mi$6. 30, ph$19. 80 PB 145 171

The oxidation of niobium was studied at pressures of 760 to 10^{-2} torr (mm Hg) and at temperatures from 150° to 1000°C by gravimetric and volumetric rate measurements, X-ray and electron diffraction, and electron microscopy. The linear (I) oxidation, in the initial stages of the oxidation up to 550°C, represents a phase boundary-controlled dissolution of O into the metal lattice; no oxides were present on the metal surface. The parabolic (II) oxidation is probably due to the diffusion of O, either through a growing layer of NbO_x or through an O-saturated Nb zone of increasing thickness, becoming rate determinable. NbO_x is formed during this oxidation stage at temperatures below 400°C; above 400°C NbO_x is not readily formed. The transition between II and the linear (III) oxidation is connected to a nucleation of γ-Nb_2O_5 on the surface of the sheet and not to a breakdown of a protective oxide film. The extension of the transition stage decreases with increasing temperature. Oxidation III also represents a phase boundary-controlled reaction and shows a square root dependence on O pressure; no transition to pressure independence occurred within 760 to 10^{-2} torr (mm Hg). The parabolic IV and V oxidations show a pressure dependence unusually high for a normal Wagner type of oxide growth. Temperate changes cause only negligible effects on the parabolic rate constants at 500° to 600°C. Deviations from the generalized oxidation behavior were found for the oxidation in O of 1 mm Hg above 600°C. Under these conditions, the oxidation seems near to normal in the beginning of the runs, but later the oxidation successively becomes slower than expected from the generalized behavior and almost stops before the sheets are oxidized throughout.

Chicago U., Ill.
CHEMISTRY OF GALLIUM, by Warren C. Johnson. Progress rept. for 1 June-1 Aug 47 on Contract N6ori-20, T.O. 16. [1947] 7p.
Order from LC mi$1.80, ph$1.80 PB 145 454

Research was conducted on: Sublimation experiments; Reaction with excess Ga_2O_3; Ball-mill for grinding reactants; Apparatus for filtration under vacuum; Results of ether extraction of reaction products; X-ray diffraction studies; Apparatus for reaction between Ga_2O_3 and NH_4Cl at atmospheric pressure; and Study of analytical methods. (See also PB 98 426, PB 98 618, and PB 105 062.

Chicago U., Ill.
THERMODYNAMIC STUDY OF InSb USING A MASS SPECTROMETER, by G. DeMaria, J. Drowart and M. G. Inghram. Technical rept. no. 9, 1 July-30 Sep 58, on Contract DA 11-022-ORD-1993. [1958] 23p. 23 refs. WAL-803/19-3; OOR rept. 1543.11P; AD-210 754.
Order from LC mi$2.70, ph$4.80 PB 144 921

The molecules in thermodynamic equilibrium with solutions of indium and antimony have been determined and their partial pressures measured. The partial molar free energy, heat and entropy of solution of antimony in liquid InSb have been calculated.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
TEMPERATURE DEPENDENCE OF MICELLULAR SOLUBILIZATION, by A. Mankowich. 23 Oct 59, 27p. 9 refs. Rept. CCL-85; AD-228 293.
Order from LC mi$2.70, ph$4.80 PB 145 107

The temperature dependence of micellar solubilization was determined in the 140° - 180° F temperature range using a dye (orange OT) solubilization technique with built and unbuilt solutions of three high cloud point commercial surfactants, one an anionic agent of the alkyl aryl suphonate type (SDBS) and two types of nonionic agents, polyoxyethylene sorbitan monolaurate (PSML) and pentadecaethylene glycol nonyl phenyl ether (PGNPE). It was found that the logarithm of solubilization in both built and unbuilt solutions was directly proportional to temperature (solubilization was an exponential function of temperature), and that the log solubilization - temperature slopes of the built and unbuilt solutions of each surfactant were approximately parallel. The linearity of the log solubilization - log concentration function for built and unbuilt surfactant solutions was confirmed at all temperatures. For 0.58:1 to 1.73:1 mole ratios of builder - SDBS, the enhanced solubilization was independent of builder type (neutral Na_2SO_4 or polyphosphate $Na_5P_3O_{10}$); that is, equimolar amounts of Na_2SO_4 or $Na_5P_3O_{10}$ increased solubilization by sodium dodecyl benzene sulphonate equally. In the temperature range studied, no uniform trend for the effect of builders on micellar solubilization by nonionic surfactants was noted. (Author)

Cornell U. [Ithaca, N. Y.]
THE FORMATION OF A DINUCLEAR Cr (III) SPECIES BY OXIDATION OF CHROMOUS SOLUTIONS, by Michael Ardon and Robert A. Plane. Rept. on Contract AF 49(638)279. 23 Oct 58, 12p. 18 refs. AFOSR-TN-58-936; AD-205 090.
Order from LC mi$2.40, ph$3.30 PB 137 843

The dissolved chromic species formed when chromous perchlorate is oxidized in aqueous solution by molecular oxygen is shown by visible spectrum and behavior toward a cation exchange resin to be the same as the hydrolytic polymer which forms first when chromic solutions are refluxed. Analysis of the solution for chromium, perchlorate, and free acid show the species to have a charge of +2 per Cr atom. Ion exchange experiments indicate that +4 is the most likely charge for the entire species, which is consistant with its being dinuclear Cr(III) species with the two Cr atoms bound by either an O or two OH bridges. This same product can be formed by oxidation of Cr^{++} with Tl^{+3} and in lower yield by ClO_3^-, HClO, $Cr_2O_7^=$ and H_2O_2. It is absent when the oxidation is performed with Fe^{+3}, Cu^{++}, Cl_2, or Br_2. It is believed that the dimer results from reaction of the intermediate Cr(IV) with Cr^{++}. (Author)

Duke U., Durham, N. C.
RESEARCH ON THE MANGANESE DIOXIDE ELECTRODE, by W. C. Vosburgh. Terminal rept. on Contract Nonr-1016(00). 26 Feb 58, 12p. 9 refs. AD-153 969.
Order from LC mi$2.40, ph$3.30 PB 137 803

Discharge of MnO_2 electrodes in acid solution: The electrodes were made by electrodeposition of graphite rods from a bath of $MnSO_4$ and H_2SO_4 between 75° and 90°C. The electrolyte was usually 0.045M H_2SO_4. The potential of the MnO_2 electrode was measured against a calomel electrode. The total Mn^{++} in the solution was found by titration and the oxidation value of the MnO_2 was calculated from the time and the current, assuming 100% current efficiency. The calculated composition of the MnO_2 was variable and the total amount was always less than the 0.2 mmol usually found by chemical analysis for similar electrodes. The Mn was also more variable than it should have been. After an apparently complete discharge some MnO_2 always remained on the electrode. The effect of the NH_4Cl concentration of the electrolyte on the potential of MnO_2 electrode: The change of MnO_2 electrode potential was measured with pH for a sample of precipitated MnO_2 in NH_4Cl electrolyte. The change in potential with pH was close to the theoretical value given by the equation, $E = E_0 - 0.059$ pH. The effect of adsorption of Mn^{++} ion on the MnO_2 electrode potential: All detectable Mn^{++} was removed from solutions of NH_4Cl and $MnSO_4$ with NH_3 by adsorption or reaction with MnO_2. The termination of a discharge: The discharge of the MnO_2 electrode was terminated when the discharge curve (potential against time) turned fairly sharply downward and the potential decreased more and more rapidly. The Mn^{++} given to the electrolyte at different stages of these discharges was measured.

Frick Chemical Lab., Princeton U., N. J.
CHEMICALLY INDUCED VIBRATIONAL EXCITATION: A STUDY OF THE HYDROXYL RADICALS FORMED IN THE H + O_3 ATOMIC FLAME, by David Garvin. Technical note no. 4 on Contracts AF 18(600)134 and CSO 680-56-30. 20 Nov 58, 31p. 26 refs. AFOSR-TN-58-1076; AD-207 455.
Order from LC mi$3.00, ph$6.30 PB 144 853

The vibrational-rotational spectrum of the hydroxyl radical in its electronic ground state has been determined in the visible and near infra-red region. Line systems in twenty-seven vibrational bands have been identified. Intensities of lines in eighteen bands are reported.

General Electric Co., Schenectady, N. Y.
INVESTIGATION OF VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS, by J. H. Affleck. Scientific rept. no. 6 on Contract AF 19(604)4093. 14 Dec 59, 20p. 27 refs. AFCRC-TN-60-104.
Order from LC mi$2.40, ph$3.30 PB 145 364

The thermionic constants have been determined for a number of refractory substrates in combination with a barium activator. Effects of inadequate coverage of the substrate by the activator are discussed, and evidence is presented showing how this influences the measurements. The barium-tantalum carbide system has a low Richardson work function and is to be examined in more detail. (Author) (See also PB 144 187)

Industrial Research and Development Labs., (Gt. Brit.)
GENERAL MECHANISM OF DRAINAGE FROM SOLID SURFACES, by J. S. Stanley and J. A. Radley. Final technical rept. for 1 Oct 58-1 Oct 59 on Contract DA 91-591-EUC-929. 31 Oct 59, 87p. 17 refs.
Order from LC mi$4.80, ph$13.80 PB 144 911

Drainage of pure liquids from solid surfaces which they wet completely has been found to follow Bikerman's drainage equation which expresses the rate of flow of a Newtonian liquid draining from a smooth vertical surface under gravity. The experiments described in this report, however, give evidence of hitherto unsuspected properties of wetting agents. All types of wetting agents tested, anionic, nonionic and cationic behaved qualitatively in the same way, although the actual concentration at which the maxima and minima occurred were dependent upon the electrolyte concentrations of the solutions and upon the structure of the wetting agents. Simple salts and acid dyestuffs that were not surface active had no effect on the quantity of solution retained at the surface. Possible applications of these results in the study of adhesives and lubrications are described.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
STUDIES ON THE LOWER OXIDES OF TITANIUM, by A. D. Pearson, Doctoral thesis. Rept. on Contracts Nonr-1841(10) and AT(30-1)1937. June 57, 54p. 35 refs. Technical rept. 120; AD-135 252.
Order from LC mi$3.60, ph$9.30 PB 137 818

Pure TiO is face-centered cubic (fcc) above ca. 950°C. The structure of samples annealed below this temperature is complex, consisting of 2 or possibly 3 phases not in equilibrium. Impurities and excess of O stabilize the fcc form at room temperature. The electrical resistivity of TiO (prepared by melting) is 2.81×10^{-4} ohm cm at room temperature, and increases with temperature between -162° and 362°C. The thermoelectric e.m.f. of TiO is of the same order of magnitude as that of metals. The directly measured density is less than that calculated from the lattice constant, indicating that 14.6% of the lattice positions are unoccupied. The properties of the products suggest that the TiO-phase oxides may be considered as solid solutions of O in Ti. X-ray investigations indicate that Ti_3O_4 probably does not exist. The trigonal unit cell of Ti_2O_3 is confirmed between room temperature and 350°C by using an improved technique for developing diffraction photographs; at room temperature $\underline{a}$ = 5.428A; α = 56°39'. The lattice parameters change rapidly between 160° and 200°C, corresponding to the rapid increase in magnetic susceptibility. Ti_2O_3 is antiferromagnetic; $\chi_m = 1.09 \times 10^{-6}$ cgs at 20°C. The thermal activation energy of electric conduction of Ti_2O_3 in the room-temperature region is 0.08 ev, about half of the observed optical activation energy (0.15 ev). The material is a p-type semiconductor at room temperature, but n-type conduction becomes dominant above 240°C.

Laval U. (Canada).
STUDY OF CHEMICAL REACTIONS IN THE ELECTRICAL DISCHARGE, by Paul A. Giguère. Technical rept. no. 50 on Contract AF 18(600)492. 10 Nov 59, 8p. AFOSR-TR-59-183.
Order from LC mi$1.80, ph$1.80 PB 144 905

The work done over the past five years is summed up. The first project, entitled: "Kinetics of the thermal decomposition of hydrogen peroxide vapor" was completed successfully. An incidental result was the discovery of the inhibiting action of hydrogen peroxide on the second explosion limit of the hydrogen-oxygen reaction. The second project "Chemical reactions in the electrical discharge" was aimed mainly at spectroscopic identification of trapped free radicals, in particular HO_2. This could not be achieved for reasons that now appear obvious. However, much useful information was obtained on the products of the reactions in dissociated water and hydrogen peroxide vapors and, lately, on the interaction of atomic hydrogen with solid ozone. (Author)

Missouri U., Columbia.
ELECTROCHEMICAL SYSTEMS FOR USE IN LOW TEMPERATURE BATTERIES, by G. V. Lago, J. P. Karnes and J. B. Jennings. Quarterly progress rept. no. 2, 17 June-16 Sep 58, on Contract DA 36-039-sc-74994. [1958]. 27p.
Order from LC mi$2.70, ph$4.80 PB 144 916

Load tests have been made on a number of cells employing MnO_2 - Shawinigan Black cathodes and Mg

anodes at room temperature and at -45°C. Initial and final "no-load" voltages were also measured. The cells have been made more uniform with respect to tightness of packing and to folding of the separator paper. No gas is evolved in the cells at -45°C. The equivalent conductances at infinite dilution and dissociation constants of KSCN-CH_3CN and KSCN-H_2O-CH_3CN systems have been calculated. Viscosities and dielectric constants have been redetermined. Some preliminary work with the KSCN-H_2O-CH_3CN has been done. (Author) (See also PB 138 837)

Naval Ordnance Test Station, China Lake, Calif.
A GRAVIMETRIC DETERMINATION OF INSOLUBLE IMPURITIES AND ASH IMPURITIES IN PROPELLANT-GRADE CELLULOSE NITRATE, by Aaron N. Fletcher. 8 Jan 59, 15p. 2 refs. NOTS-TP-2152; NAVORD Rept. 6444; AD-211 979.
Order from LC mi$2.40, ph$3.30 PB 144 870

Mixed-solvent alkaline degradation of propellant-grade cellulose nitrate is used to allow gravimetric determinations of insoluble and ash impurities in 10-g samples. The need for such large samples is indicated by the nonhomogeneity of impure cellulose nitrate. The standard deviations of measurements for precision were found to be about 0.01% for both the insoluble and the ash impurities determination. Tests for accuracy showed standard deviations of 0.03% for the insoluble impurities and 0.01% for the ash impurities when evaluated over the range 0.0 - 0.6% impurities. (Author)

Naval Ordnance Test Station, China Lake, Calif.
SOME NOTES ON TRAVEL IN EUROPE. I. SYMPOSIUM AND CONGRESS ON MODERN ELECTROCHEMICAL METHODS OF ANALYSIS. II. ACADEMIC, GOVERNMENT, AND INDUSTRIAL RESEARCH LABORATORY VISITS, by Gerald C. Whitnack. 30 Apr 58, 25p. NOTS rept. 1942; AD-200 539.
Order from LC mi$2.70, ph$4.80 PB 144 757

The primary purpose of the trip reported here was to present an invited paper at a Symposium in conjunction with the XVI International Congress of Pure and Applied Chemistry in Paris, France. In addition, official visits to academic, government, and industrial laboratories in Italy, England, and Scotland and conferences with leading scientists in the fields of electrochemistry, polarography and analytical chemistry were arranged. Although the writer is most proficient in these fields and therefore concentrated the most on them, nevertheless, a great deal of knowledge pertinent to other fields of research was obtained. This included information on high explosives, propellants, detonator compositions, chromatography, plastics, manufacturing techniques, synthesis, continuous flow processes, etc. (Author)

Naval Research Lab., Washington, D. C.
IGNITION STUDIES. PART V. STUDY OF THE PROCESSES OCCURRING DURING THE SPONTANEOUS IGNITION OF THE HEXANE ISOMERS, by W. A. Affens, J. E. Johnson, and H. W. Carhart. Interim rept. 27 Jan 60, 17p. 10 refs. NRL rept. 5437.
Order from OTS $0.50 PB 161 105

Spontaneous ignition properties of the hexane isomers in air were studied using a uniformly heated one-liter spherical Pyrex flask. Particular emphasis was placed on pre-ignition reactions by means of measurements of internal gas temperature and oxygen consumption. Time-temperature recordings of gas temperature were found to be helpful in distinuguishing between ignition and non-ignition, but not between hot- and cool-flame ignition, although in most cases this distinction could be made visually in total darkness. Minimum ignition temperature in air for cool- or hot-flame ignition, minimum reaction temperature, pre-ignition range, maximum temperature rise above base temperature, and oxygen consumption at ignition for the isomeric hexanes, appear to show correlation with ease of oxidation and ignition. The present work suggests that minimum ignition temperature for cool- or hot-flame ignition may well be a more reliable criterion for fire safety than the commonly used SIT (hot-flame ignition only). (Author) (See also PB 111 614)

Notre Dame U., Ind.
SINTERING REACTIONS OF ZINC OXIDE, by V. J. Lee and G. Parravano. Rept. on Contract AF 49(638)103. Dec 58, 26p. 6 refs. AFOSR-TN-58-811; AD-202 356.
Order from LC mi$2.40, ph$3.30 PB 137 837

Sintering has been studied from 700° to 900°C in air, oxygen, helium, and hydrogen. Fresh zinc oxide sinters rapidly in air and oxygen, but it does not sinter appreciably in helium in the same temperature range.

Pennsylvania State [U., University Park.]
SURFACE POLARIZATION AND WETTABILITY OF INORGANIC SUBSTANCES BY WATER, by D. P. Enright, L. R. Sonders and W. A. Weyl. Technical rept. no. 8 on Contract N6onr-269, T. O. 8. [1948] 7p. 6 refs. AD-221 183.
Order from LC mi$1.80, ph$1.80 PB 145 455

Some literature review is presented. An outline is given of some experiments involving anhydrous chromic chloride, cadmium iodide mercuric iodide, some clay products and glass capillaries.

Polytechnic Inst. of Brooklyn, N. Y.
STUDIES IN THE REACTIONS OF HIGH ENERGY ATOMS AND MOLECULES, by R. A. Marcus. Rept. on Contract AF 33(616)3887. Jan 59, 36p. 27 refs. WADC Technical rept. 59-24; AD-209 533.
Order from OTS $1.00 PB 151 875

The results obtained in three individual studies are summarized in this final report. A theory is presented which relates the lifetimes of excited molecules formed by light absorption to the wavelength of the exciting light and to the temperature. Measurements of the reaction products from the flash photolysis of acetone are reported for various acetone pressure temperatures, light intensities, wavelengths,

and varying pressures of added oxygen, biacetyl and some hydrocarbons. The measurement of reaction products in flash systems provides helpful, direct information about the primary species produced by light absorption. Various trends in the data indicate the presence of certain excited molecules and hot radicals as well as the usual thermal radicals. The construction of an apparatus is described for the measurement of the rate of a chemical reaction as a function of the relative velocity of the two reactants. In this apparatus a high energy beam of monoenergetic helium atoms is used to bombard hydrogen molecules at room temperature. Preliminary results indicate the formation of hydrogen atoms by this technique, as evidenced by their blue coloration of molybdenum oxide. Various components to be used to make this study a quantitative one are outlined. (Author)

Princeton U., N. J.
PRELIMINARY STUDY OF THE LIGHT SCATTERING TECHNIQUE FOR DETERMINATION OF SIZE DISTRIBUTIONS IN BURNING SPRAYS, by R. A. Dobbins. Technical rept. on Contract AF 18(600)1527. 15 July 58, 54p. 18 refs. Aeronautical Engineering Lab. rept. no. 430; AFOSR-TN-58-822; AD-202 906.
Order from LC mi$3.60, ph$9.30 PB 138 169

Purdue U., Lafayette, Ind.
STRESS RELAXATION AND EXCHANGE IN PELLETS USED FOR THE INFRA-RED TECHNIQUES, by F. Vratny. Rept. on Contract AF 18(603)45. Aug 58, 11p. 4 refs. AFOSR-TR-58-867; AD-203 668.
Order from LC mi$2.40, ph$3.30 PB 138 165

In the pelleting of lead nitrates for infra-red study, exchange between lead nitrate and potassium chloride proceeds at a logarithmic rate. Water adsorption and stress relaxation also proceed at logarithmic rates. Increasing the rate of water adsorption enhance the rate of exchange and stress relaxation. (Author)

Purdue U., Lafayette, Ind.
THE THERMAL DECOMPOSITION OF PRASEODYMIUM NITRATE, by F. Vratny and J. M. Honig. Rept. on Contract AF 18(603)45. Nov 59, 30p. 15 refs. AFOSR-TN-59-1153.
Order from LC mi$2.70, ph$4.80 PB 144 944

The thermal decomposition of $Pr(NO_3)3$ has been measured in the temperature range $285 \leq T \leq 485^oC$. In conjunction with infrared spectra of the solid decomposition products it is postulated that the reaction proceeds via an intermediate nitrite structure. The composition of the final nonstoichiometric oxide varied with the temperature at which the reaction was allowed to proceed. Various characteristic features of this decomposition reaction are discussed. (Author)

Rochester U., N. Y.
THE FLUORESCENCE AND PHOSPHORESCENCE OF ACETONE VAPOR, by Julian Heicklen. Rept. on Contract AF 18(600)1528. 12 Sep 58, 6p. 4 refs. AFOSR TN-58-847; AD-203 337.
Order from LC mi$1.80, ph$1.80 PB 138 245

Light emission from acetone has been studied with incident radiation from 2800A to 3130A.

Rochester U., N. Y.
PHOTOCHEMICAL STUDIES 54. METHANOL VAPOR, by Raymond P. Porter and W. Albert Noyes, Jr. Rept. on Contract AF 18(600)1528. 12 Sep 58, 24p. 17 refs. AFOSR-TN-58-848; AD-203 338.
Order from LC mi$2.70, ph$4.80 PB 138 149

The principal products of the photochemical decomposition of methanol vapor at wave lengths below 2000 Å are hydrogen, formaldehyde, ethylene glycol together with small amounts of carbon monoxide and methane. By use of scavengers and by study of deuterated methanol, CD_3OH, at least two primary processes must occur: (1) $CH_3OH + h\nu = CH_2O + H_2$; 2) $CH_3OH + h\nu = CH_3O + H$. Other primary processes, including the formation of hot methoxy radicals and hot hydrogen atoms, may occur but conclusive evidence for or against them could not be obtained. Secondary reactions are discussed. Methoxy radicals must, by abstraction, form CH_2OH radicals, and CH_2OH radicals must also be formed by the reaction $H + CH_3OH = CH_2OH + H_2$. (Author)

Syracuse U., N. Y.
SOLUBILITY OF IRON IN LIQUID LITHIUM, by John J. Sand. Rept. on Subcontract to Olin Mathieson Chemical Corp. Contract AF 33(600)33920. 22 Aug 58, 40p. 15 refs. OMCC-HEF-166.
Order from LC mi$3.00, ph$6.30 PB 145 280

The solubility of iron in lithium over the temperature range 200°C to 1200°C is estimated to be $S^o_T = 0.178T - 17.5$ where: S^o_T = the equilibrium solubility of iron in lithium, PPM Fe/Li (parts by weight of Iron per million parts by weight lithium) and T = temperature in degrees C. The experimental method used was to heat the Iron capsules containing lithium to equilibrium at specific temperatures and then to quench them in a CO_2 - oil bath at -30°C. Each quenched iron-lithium sample was analyzed colorimetrically for iron and then by titration for lithium.

Texas U., Austin.
CHEMICAL KINETICS IN LINEAR FLOW SYSTEMS I, by J. A. Cunningham and F. A. Matsen. Technical note 4 on Contract AF 18(603)142. Oct 58, 9p. 2 refs. AFOSR-TN-58-872; AD-203 916.
Order from LC mi$1.80, ph$1.80 PB 138 148

Equations are developed describing the kinetics in a flow system assuming parabolic flow. While these equations are more complex then the equations for planar flow developed in the preceding technical note, they do not improve the description of the thermal decomposition of butane. (Author)

Theoretical Chemistry Lab., U. of Wisconsin, Madison.
SOLUTIONS FOR COMPLEX SYSTEMS OF CHEMICAL REACTION KINETICS. PART I. AN IRREVERSIBLE UNIMOLECULAR REACTION FOLLOWED BY A SECOND IRREVERSIBLE UNIMOLECULAR REACTION, by David D. Konowalow, James E. Blair and others. Rept. on Theory of Propagation of Flames and Detonations, Contract AF 33(616)3414. Aug 59, 44p. WADC Technical note 59-243, Pt. 1.
Order from OTS $1.25 PB 161 408

The analytical solutions of the rate equations for the system $A \xrightarrow{k_1} B \xrightarrow{k_2} C$ are explored for characteristic features which are useful to the kineticist in determining the rate constants from fragmentary experimental data. Among the most useful features are the maximum which B exhibits and the time at which it occurs from which both rate constants can be determined. A critical examination of the pseudostationary state approximation as applied to this system is made The approximation is found to be accurate when the intermediate B is short lived. (Author)

Trinity Coll., Dublin (Eire).
MAGNETOCHEMICAL BEHAVIOUR OF THE 7-SUBSTITUTED 8-HYDROXYQUINOLATES OF NICKEL, by William J. Davis and Ronald E. Burton. Final technical rept. no. 1, 1 Oct 58-1 Oct 59, on Contract DA 91-591-EUC-96001-1069-59. 1 Oct 59, 13p. 12 refs.
Order from LC mi$2.40, ph$3.30 PB 144 889

This work was undertaken to elucidate the structure and behavior of the complexes formed by nickel with certain 8-hydroxyquinolines (oxines) substituted in the 7-position. The main effort has been concentrated on (a) the synthesis of 7-substituted 8-hydroxyquinolines, (b) the examination of the compounds formed between nickel ions and these oxines, (c) the construction of a precision magnetic susceptibility balance, and (d) measurements of magnetic susceptibilities of nickel oxinates.

West Virginia U., Morgantown.
COMPLEXES OF COPPER(II) ION AND 2-AMINO-2(HYDROXYMETHYL)-1, 3-PROPANEDIOL, by James L. Hall and Joe A. Swisher. Technical rept. no. 5, 1 June 58-31 Aug 59, on Metal Ion Complexes of Oxygen-Substituted Amines, Contract DA 36-061-ORD-579. 15 Nov 59, 15p. 12 refs. OOR rept. 1604.11-C.
Order from LC mi$2.40, ph$3.30 PB 144 913

The coordination compounds formed by copper(II) ion and 2-amino-2(hydroxymethyl)-1, 3-propanediol have been studied in solution and by the preparation of crystalline compounds. The amine, $H_2NC(CH_2OH)_3$, is commonly named tris-(hydroxymethyl)-aminomethane and will be abbreviated tris.

Wisconsin U. [Madison].
HYDROGEN BONDING STUDIES. IV. ACIDITY AND BASICITY OF TRIPHENYLHYDROXY COMPOUNDS OF GROUP IVB ELEMENTS AND THE QUESTION OF PI-BONDING FROM OXYGEN TO METALS, by Robert West and Ronald H. Baney. Rept. on Contract AF 49(638)285. 8 Dec 59, 19p. 26 refs. AFOSR-TN-59-1207.
Order from LC mi$2.40, ph$3.30 PB 144 865

The acidity and basicity as hydrogen bond donors and acceptors has been measured for the compounds Ph_3MOH, where M = C, Si, Ge, Sn and Pb. The trends in acidity and basicity in these compounds indicate that dative pi-bonding from oxygen to M is strong in Ph_3SiOH, weaker in Ph_3GeOH, and negligible in the other three compounds. A linear relationship has been found between νOH and the electronegativity of M, for these and related hydroxyl compounds. (Author) (See also PB 142 157)

Wisconsin U., Madison.
STUDIES OF PERCHLORYL FLUORIDE FLAMES, by R. Maurice Lodwig and John L. Margrave. Technical rept. on Contract DA 11-022-ORD-1818. 31 May 58, 24p. 19 refs. OOR rept. 1428.5-6; AD-137 094.
Order from LC mi$2.70, ph$4.80 PB 145 083

Wisconsin U., Madison.
THE VAPOR PRESSURE OF NICKEL FLUORIDE, by Milton Farber, Richard T. Meyer, and John L. Margrave (Jet Propulsion Lab.). Technical rept. on Contract DA 11-022-ORD-1818. 1 Mar 58, 6p. 9 refs. AD-158 448.
Order from LC mi$1.80, ph$1.80 PB 144 859

The vapor pressure of NiF_2 was measured to see if the objection raised about the possibility that NiF_2 might be sufficiently volatile at high temperatures to complicate the interpretation of the data was checked for its validity for experiments carried out in Ni containers. Vapor pressure was measured by the Knudsen effusion method over the range 1026 to 1104°K and the flow method with N_2 as the flow gas over the range 1233° to 1349°K. Results indicated that the vapor pressure of NiF_2 is a negligible part of the F pressure deviation observed by Doescher (J. Chem. Phys. 19:1070, 1951; 20: 330, 1952), and $NiF_2(g)$ was not present in high enough concentrations to change the interpretation of the effusion data of Wise (J. Chem. Phys. 20:927, 1952).

EARTH SCIENCES

Willow Run Labs., U. of Michigan, Ann Arbor.
OBSERVATIONS OF HIGH-FREQUENCY SEISMIC ENERGY, by D. E. Willis, R. C. Fitzpatrick, and J. T. Wilson. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Jan 59, 17p. Rept. no. 2144-305-T.
Order from LC mi$2.40, ph$3.30 PB 145 119

Observations of seismic waves generated by nuclear and high-explosive blasts and earthquakes were made with standard refraction-type geophones. The output

of the geophones was recorded on magnetic tape and seismic level recorders. A comparison and analysis of seismic data from various sources is shown. . High-frequency seismic waves appear to have been transmitted over large distances from the three types of sources. (Author)

Climatology and Meteorology

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
HIGH ALTITUDE CLOUD PHOTOGRAPHY FROM BALLISTIC MISSILES, by D. N. Vachon and J. I. F. King. Rept. on Contract AF 04(647)269. 1 Dec 59, 17p. Technical Information Series R59SD471.
Order from LC mi$2.40, ph$3.30 PB 145 181

During the time between separation and re-entry, the nose cones of IRBM's and ICBM's can be utilized for many scientific purposes. Recently during the normal course of flight testing, 16mm films were used to record the separation and stabilization processes. Although the camera system was not designed for cloud photography, we were able to obtain some extremely useful information. A brief analysis of the cloud systems has been made and is summarized with the use of a limited number of prints. The potential of future cloud photography during flight tests is explored.

Air Force Cambridge Research Center, Bedford, Mass.
THE METEOROLOGICAL MEASUREMENTS AND FIELD PROGRAM OF PROJECT JET STREAM FROM 1956 TO 1958, by R. M. Endlich and R. M. Rados. Oct 59, 134p. 23 refs. Geophysical Research Papers no. 64; AFCRC-TR-59-266.
Order from OTS $2.75 PB 161 432

During the course of "Project Jet Stream," a number of meteorological research flights were made at altitudes from 25,000 to 40,000 feet in a B-47 aircraft equipped with special instruments for measuring winds, temperatures, pressure, turbulence, etc. The measurements from 36 flights conducted from Wright-Patterson Air Force Base, Dayton, Ohio, during 1956-1957 have been processed for use in research efforts. These data pertain to several operational problems of aircraft and missiles and to many fundamental meteorological questions; therefore, they are being made generally available for study. To use the data intelligently, some familiarity with the measuring instruments and with the conduct of the field program is required. This paper is intended to supply this background. Methods of data reduction and the final forms in which the data are presented are also described. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
A NOTE COMPARING 1-KM VERTICAL WIND SHEARS DERIVED FROM SIMULTANEOUS AN/GMD-1A AND AN/GMD-2 WINDS-ALOFT OBSERVATIONS, by H. A. Salmela and N. Sissenwine. Nov 59, 15p. GRD Research Notes no. 22; AFCRC-TN-59-496.
Order from OTS $0.50 PB 161 429

Winds-aloft observations that were taken simultaneously by the AN/GMD-1A and AN/GMD-2 rawin sets during field trials of the new AN/GMD-2 at Andrews AFB, Maryland are analyzed and compared. For wind-speed differences for approximately one kilometer of ascent (actually three minutes) equal to and greater than 20 mps as observed by the GMD-2, the distribution of the differences as observed by the GMD-1A is presented. The maximum wind differences for the positive shear (wind increasing with height) and the negative shear (wind decreasing with height) as observed by the GMD-1A are compared with the simultaneous differences reported by the GMD-2. These latter differences give the approximate true shears. Comparison of the two sets of vertical wind shears (wind-speed differences) makes it possible to obtain a quantitative estimate of the exaggeration in the vertical wind shears indicated by operational GMD-1A soundings. (Author)

Cloud Physics Lab., U. of Chicago, Ill.
CLOUD REFRACTIVE INDEX STUDIES. PART II: USE OF DISTRIBUTIONS OF ΔN VS. ΔS FOR ESTIMATING MECHANICAL TURBULENCE, by Roscoe R. Braham, Jr. Edward L. Harrington, and Thomas E. Hoffer. Technical note no. 17 on Contract AF 19(604)1931. 2 Sep 58, 36p. 2 refs. AFCRC-TN-58-613; AD-206 771.
Order from LC mi$3.00, ph$6.30 PB 137 910

An analysis was made of fine structure variations of refractive index in and around a group of about 70 cumulus clouds with a view toward relating these variations to mechanical turbulence parameters. Frequency distributions of refractive index gradients were prepared for each level of flight for clear air, cloud core and regions of transition at the cloud boundaries. Similar distributions were prepared for refractive index increments. The latter distributions in the form of tables of N change vs. gradient size (ΔS), are presented as an appendix. From these distributions a parameter analogous to the "mixing" length" of early turbulence theory was computed. This study shows that eddies of the transition regions of cumulus clouds have dimensions of a few tens of meters and are carried for distances of the order of 30-50 meters before losing their identity. Mixing lengths of clear air eddies are much larger than those of cloud eddies, except, possibly, for those eddies in the uppermost parts of the clouds. (Author)

Deutscher Wetterdienst, Frankfurt (West Germany).
TEMPERATURE OF MIDWINTER AND PRECEDING SOLAR ACTIVITY, by E. Dinies. Scientific rept. no. 1 on Contract AF 61(514)954c. Oct 56, 9p. 1 ref. AFCRC-TN-57-279; AD-117 164.
Order from LC mi$1.80, ph$1.80 PB 137 680

Florida State U., Tallahassee.
A NUMERICAL EXPERIMENT IN DEDUCTION OF THE DIVERGENCE ASSOCIATED WITH A MODEL OF A STEADY COLD CYCLONE, by Stanley E. Asplund. Technical rept. no. 14 on Contract Nonr-1600(00). 31 Jan 59, 212p. 62 refs.
Order from LC mi$9.60, ph$33.30 PB 144 555

The tropospheric wind structure in a sub-class of cut-off cold-core cyclones is idealized in a model. This model is a hypothetical case in which velocity divergence is present in exactly the right amount to maintain a zero local rate of change of vorticity. The rotational nondivergent part of the total wind field is prescribed. The divergent irrotational part is obtained by an iterative numerical process based upon evaluation of divergence from the vorticity equation. Beginning with the lower-boundary assumption of vertical velocity, the divergence required to balance all other contributions to vorticity tendency is computed at 100 mb intervals. Successive pressure surfaces are linked by numerical integration of the continuity equation. Computations and results through 500 mb are reported and discussed. The model wind field is prescribed by mathematical expressions for zonal wind superimposed on a vortex at a reference surface of 565 mb.

Massachusetts Inst. of Tech., Cambridge.
THE EVALUATION OF SUBJECTIVE PROBABILITY FORECASTS, by Frederick Sanders. Scientific rept. no. 5 on Contract AF 19(604)1305. June 58, 63p. 6 refs. AFCRC-TN-58-465; AD-160 741.
Order from LC mi$3.90, ph$10.80 PB 137 505

An evaluation is made of a large number of subjective probability forecasts referring to a wide variety of weather elements and conditions and to time periods up to twenty hours in advance. These forecasts are found to be generally quite reliable, if reliability is measured by the correspondance between each forecast probability value and the corresponding percent frequency of occurrence of the forecast weather condition (mean "observed" probability value). The forecast probability values and the corresponding percent frequencies of occurrence are expressed in terms of departures from climatological expectancy. It is then found that the observed departure values are only about three quarters of the forecast departure values. A method is presented of scoring the probability forecasts in terms of a percent reduction over climatology. It is shown that this percent reduction suffers not only because of lack of reliability, as defined above, but also because of lack of resolution. The resolution of a set of forecasts representing a particular forecast probability value is measured by the variance of the individual "observed" probability values about their mean for that set. Lack of resolution is primarily responsible for the rather modest percent reduction yielded by the subjective probability forecasts. A negative percent reduction is found in those forecasts which refer to weather conditions which occur either very infrequently or very frequently. Probabilistic forecasts are discussed in relation to categorical forecasts, and some advantages of the former are elucidated. (Author)

Meteorologic Lab., U. of Illinois, Urbana.
EVALUATION OF THE AN/APQ-39(XA-3) CLOUD DETECTOR RADAR, by K. E. Wilk. Final rept. for 16 Mar 55-31 Mar 58 on Contract AF 19(604)1395. [1958] 42p. 10 refs. AFCRC-TR-58-246; AD-152 596.
Order from LC mi$3.30, ph$7.80 PB 137 693

This report is an evaluation of a ground based AN/APQ-39(XA-3) airborne radar as a cloud indicator during the winter months in the Midwest. Data on clouds, precipitation, and other meteorological parameters were collected by means of a modified AN/APQ-39(XA-3) radar, meteorological instruments, and cloud photography. The observed data and radar characteristics are analyzed to determine the empirical detection capabilities, theoretical detection capabilities, and the synoptic interpretations of the radar echoes. The results indicate the AN/APQ-39(XA-3) radar is capable of detecting 77 percent of the observed clouds. Cloud genera usually can be identified from the configuration of the radar return. The radar also provides limited knowledge of the existence and character of precipitation and of the air mass structure. (Author)

Meteorologic Lab., U. of Illinois, Urbana.
STUDY AS TO MERITS OF VARIOUS RAPID RAINDROP COUNTING AND SORTING TECHNIQUES, by Glenn E. Stout and William C. Ackermann. Final rept. for 15 May 56-13 Mar 58 on Contract AF 19(604)1900. [1958] 30p. 5 refs. AFCRC-TN-58-255; AD-152 632.
Order from LC mi$2.70, ph$4.80 PB 138 093

An extensive literature search has been made to evaluate known instruments, designs, and methods of counting rain and drizzle drops according to their sizes. Emphasis has been placed on the techniques that are adaptable to automatic registration of drop count versus various powers of drop diameter.

Naval Ordnance Test Station, China Lake, Calif.
MODIFIED RADIOSONDE FOR OBTAINING LOWER-LEVEL ATMOSPHERIC DATA, by Paul H. Miller. 1 Oct 59, 19p. 3 refs. NOTS TP-2334; NAVORD Rept. 6600.
Order from LC mi$2.40, ph$3.30 PB 145 124

A standard AMT-4 radiosonde modulator has been modified at the Naval Ordnance Test Station for use in obtaining micro-meteorological temperature data in the lower levels of the atmosphere. The modification consists of reqiring the basic circuit to eliminate the taking of relative humidity data and increase the number of high references made. The sequence of transmitted data consists of alternating low references and temperature data throughout a range of four contacts followed by a high reference. This sequence is repeated until the 105th contact is reached, a point well above the upper limit of the range of interest in a low-level sounding. The modified radiosonde may be used as either a captive instrument or attached to a slow-rising balloon. (Author)

Naval Ordnance Test Station, China Lake, Calif.
A PROPOSED RABAL SYSTEM FOR THE RAPID ACQUISITION OF HIGH-ALTITUDE WIND DATA, by Paul H. Miller. Sep 59, 15p. 4 refs. NAVORD rept. 6593; NOTS TP-2325.
Order from LC mi$2.40, ph$3.30 PB 144 984

A modified radiosonde has been assembled at the Naval Ordnance Test Station with which it is proposed to obtain high-altitude wind data more rapidly and economically than is possible with existing equipment. The unit consists of a battery and an AN/AMT-4 transmitter that emits an unmodulated carrier signal. The unit may be tracked with either one or two GMD-1 tracking antennas depending on whether the desired winds-aloft data is to be obtained by using an assumed ascension rate or by triangulation. Advantages and disadvantages of both methods are outlined. The suggested configuration and methods eliminate many of the steps now involved in the determination of high-altitude winds. (Author)

Naval Ordnance Test Station, China Lake, Calif.
TROPOPAUSES AND RELATED ATMOSPHERIC PHENOMENA AT THE NAVAL ORDNANCE TEST STATION, by P. H. Miller and D. L. Farnham. Nov 59, 158p. 62 refs. NOTS TP-2226; NAVORD rept. 6533.
Order from LC mi$7.50, ph$24.30 PB 145 167

Tropopause data obtained and evaluated at the Naval Ordnance Test Station indicate a very definite correlation between the major tropopauses and their leaves, and such phenomena as the jet steam, clear-air turbulence, mountain waves, and the formation of aircraft condensation trails. A review of the literature on tropopauses and related phenomena is presented. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
YUMA SUMMER MICROCLIMATE, by Arthur V. Dodd and Harry S. McPhilimy. Nov 59, 39p. 8 refs. Technical rept. EP-120.
Order from LC mi$3.00, ph$6.30 PB 145 139

Detailed and continuous temperature, wind, and radiation records for a 2-month summer period under diverse terrain conditions at Yuma Test Station, Arizona, were analyzed. It was found that the temperature regime near and at the earth's surface varies significantly from the regime as found by "standard" observations. Midday temperatures greater than 140 F were frequent on both sand and desert pavement surfaces. Temperatures at levels 200 centimeters above these surfaces were seldom more than 110 F. The wind regimes at the relatively low sandy plains and desert pavement sites were quite similar, with strongest winds in the afternoon and very light winds at night. Winds measured at the crest of a hill averaged stronger day and night and had important effects on the temperature regime. The total incoming radiation at Yuma Test Station at midday is extremely high, often exceeding 500 Btu/ft^2/hr. Outgoing radiation is also at a maximum at midday when it averages over 300 Btu/ft^2/hr. The net radiation is positive (incoming) for an average of 12 hours each day, and exceeds 150 Btu/ft^2/hr for an average of 6 hours each day. At night there is a small negative radiation balance. (Author)

Washington U., Seattle.
A METHOD OF ANALYSIS OF SURFACE GEOSTROPHIC WINDS IN MOUNTAINOUS REGIONS, by Nolan Patrick Williams. Scientific rept. no. 6 on Contract AF 19(604)3063. Aug 59, 49p. 7 refs. AFCRC-TN-59-413; AD-217 311.
Order from LC mi$3.30, ph$7.80 PB 144 581

A method of representing the air flow over mountainous terrain is derived to serve the same function as an isobaric analysis in flat regions. Constant pressure charts were analyzed at 50-mb intervals between 950 and 750 mb, the height contours being terminated where they intersected solid ground. At these intersections, geostrophic winds were measured, plotted on a base map, and analyzed by means of streamlines and isotachs. These plots gave what may be termed the true surface geostrophic wind field. This field proved very different from the geostrophic wind field corresponding to the sea-level isobars. A large fictitious gradient over the mountains of western Canada and Alaska was analyzed. The tedious process involved in obtaining the true surface geostrophic wind is not suited to practical use. An attempt was made to combine routine analyses in such a way that they yielded an equivalent result. The combination of the surface and 850-mb charts gave a satisfactory representation in most areas, though it was necessary to make use of the 700-mb chart in the vicinity of the St. Elias Range. (Author)

Washington U. [Seattle]
RESULTS OF A SERIES OF DYNAMICAL PREDICTIONS FOR THE ARCTIC: WINTER SEASON, by Richard J. Reed. Scientific rept. no. 8 on Contract AF 19(604)3063. Sep 59, 56p. 14 refs. AFCRC-TN-59-415; AD-217 313.
Order from LC mi$3.60, ph$9.30 PB 144 690

A series of 24-hr forecasts of 1000 and 500-mb height, and 1000 to 500-mb thickness for the area north of 60° are presented for a 20-day period in December 1956 and January 1957. The forecasts are based on graphical integrations of a two-level baroclinic model. An approximate and exact method were used to convert vorticity changes to height changes. The verifications include both types of forecasts. The performance of the daily forecasts, as expressed by space correlations and root-mean-square errors, was slightly better than for an earlier arctic forecast (AD-211 493), and somewhat poorer than for similar forecasts for the US and Canada. The differences in performance can be explained largely on the basis of the degree of synoptic activity and the equality of the map analyses. From the time correlations (or correlations at grid points) and the corresponding root-mean-square errors, results indicate that the method performed best in or near regions where the observed root-mean-square pressure or height changes were largest. The forecast accuracy seemed to be sensitive to the synoptic regime and, other things being equal, to be greater at middle latitudes where weather changes are more active. (Author)

Washington U. [Seattle]
A SYNOPTIC-CLIMATOLOGICAL STUDY OF THE ARCTIC CIRCULATION IN SUMMER, by Bruce Arlen Kunkel. Scientific rept. no. 7 on Contract AF 19(604)3063. Sep 59, 53p. 20 refs. AFCRC-TN-59-414; AD-217 312.
Order from LC mi$3.60, ph$9.30 PB 144 691

Estimates of cyclone and anticyclone frequencies for the area north of 60°N for the summer season were revised using data for the 5 years, 1952-56. In view of the different pictures these recent data give regarding the arctic circulation in summer, mean monthly sea-level pressures for the 5-year period and frequencies of various types of fronts were obtained. Results indicate that the inner arctic is a region of high cyclone frequency in summer. The large frequency and great persistence of the lows makes this region somewhat analogous to the Aleutian and Icelandic regions of semipermanent low pressure. The lows in the Arctic Basin have their origin mainly over Siberia and may be attributed to the strong baroclinic zone that develops along the arctic coast in summer. Greatest frequency of anticyclones is found in the zone about 75°N. Instead of a single polar front displaced far northward from its winter position, 2 belts of high frequency were found, one off Japan and another along the arctic coast. Minimum frequencies occurred in the area formerly believed to be occupied by the polar front. (Author)

Frost Science

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
TABLES OF KELVIN FUNCTIONS AND THEIR DERIVATIVES, by D. E. Nevel. Rept. on Mechanics of Ice Sheets. June 59, 75p. 3 refs. Technical rept. 67.
Order from LC mi$4.50, ph$12.30 PB 145 116

Tables of the basic functions necessary for the solution of problems related to the trafficability of ice sheets are tabulated, including the following functions and their first derivatives: ber (χ), bei (χ), ker (χ), kei (χ), ber_ϕ (χ), and bei_ϕ (χ) for $0 \leq X \leq 1$ ($\Delta X = 0.001$), $1 \leq X \leq 6$, ($\Delta X = 0.01$), and $6 \leq X \leq 10$ ($\Delta X = 0.1$). A differential equation is given which describes the bearing capacity of a floating ice sheet (considered as a plate on an elastic foundation) together with a solution in terms of Kelvin functions. The formulas for these functions and their first derivatives are also presented. The functions were computed with a Bendix G-15D electric computer and are accurate to the last digit (12th), except for 4, which are occasionally in error in the last digit. (Author)

Dartmouth Coll., Hanover, N. H.
ICE STRUCTURES, ANGIUSSAQ LAKE, NORTHWEST GREENLAND, by L. D. Taylor and J. B. Lyons. Scientific rept. no. 1 on Contract AF 19(604)2159. 1 Sep 59, 37p. 27 refs. AFCRC-TN-59-461.
Order from LC mi$3.00, ph$6.30 PB 144 799

A discussion is presented of the structural and textural features of the four major ice types underlying perennially-frozen Angiussaq Lake, Northwest Greenland. Major attention is focused on the lake ice and the major and minor features which contribute to its strength and suitability as an aircraft landing platform. The other ice types - glacial ice, coarse-grained stratified ice, and granular stratified ice - are of minor areal extent, but of significance in unravelling the developmental history of the lake. Strength tests on the lake ice, carried out by Barnes, indicate its ability to support a C-124, even at the height of the thaw season. Surface imperfections in the ice cover, however, make it unsafe for landings at that time of the year. Suggestions are offered for a few simple modifications which could possibly convert the lake ice surface into a suitable all-weather airstrip. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
SQUAW VALLEY WINTER TRIALS, 1958-59, COMPACTED-SNOW PARKING STUDY ON MEADOW LAND by R. C. Coffin, Jr. Final rept. 16 Nov 59, 67p. 5 refs. Technical rept. 051.
Order from LC mi$3.90, ph$10.80 PB 145 156

The results of constructing, trafficking, and maintaining a 15-acre compacted-snow public parking lot on the meadow at Squaw Valley, California, during the winter of 1958-59 are presented. It is concluded that a compacted-snow mat can be built in January and maintained through February provided there is at least 18 in. of snow pack, that night temperatures are usually below freezing, and that the area is adequately protected against runoff water from surrounding areas. (Author) (See also PB 137 880)

Geodesy

Aeronautical Chart and Information Center, St. Louis, Mo.
GEODESY FOR THE LAYMAN, by Richard K. Burkard. Oct 59, 83p.
Order from OTS $2.25 PB 161 372

The use of intermediate and long range rockets and missiles requires that the distance and direction from launch site to target be accurately known. The science of geodesy can help to provide this information. The basic principles of geodesy and geodetic surveying are presented in an elementary form. The formation of geodetic datums is introduced and the necessity of connecting or joining datums is discussed. Methods used to connect independent geodetic systems to a single world reference system are discussed. Particular emphasis is placed on the Air Force role in developing a World Geodetic System. (Author)

Air Force Missile Test Center, Patrick AFB, Fla.
RESULTS IN GEODETIC PHOTOGRAMMETRY. I: THE PRECISE DETERMINATION OF THE LOCA-

TION OF BERMUDA FROM PHOTOGRAMMETRIC OBSERVATIONS OF FLARES EJECTED FROM JUNO II, by Duane C. Brown. Rept. on Missile Test Project, Contract AF 08(606)1156. 27 Oct 59, 33p. 4 refs. RCA Data Processing Technical rept. no. 54; AFMTC-TR-59-25.
Order from LC mi$3.00, ph$6.30 PB 144 794

Photogrammetric observations of a pair of flares ejected from a Juno II rocket have led to the determination of the location of Bermuda on the North American Datum. Bermuda's position was altered by 1".2 ±0".54 in latitude and by 6".8 ±0".60 in longitude, the total displacement amounting to 176.5 ±17.5 meters. The success of this venture provides further support to the thesis that advanced photogrammetric techniques are capable of producing geodetic positions to first order accuracy over very long distances. Suggestions on various aspects of a possible global program of geodetic photogrammetry are forwarded. An appendix considers the problem of adjusting a general photogrammetric net when not only the plate coordinates, but also any elements of camera orientation and any coordinates of control are considered to be observed quantities subject to significant errors of known variance and covariance. (Author)

O'Neill, Hugh T., and Associates, Annapolis, Md.
NEW METHODS OF RECONNAISSANCE AND INTELLIGENCE FROM AERIAL PHOTOGRAPHY, ESPECIALLY BY MEANS OF NEW TYPES OF FILMS AND FILTERS. Technical rept. no. 1 on Contract AF 33(616)262. 30 Sep 53, 86p. AD-203 988.
Order from LC mi$4.80, ph$13.80 PB 145 444

Contents:
Part I. A basic study of the factors which influence the recognition of objects in aerial photographs
Part II. Preliminary review and study (of) past and present color systems, processes and techniques to determine their possibilities for inclusion in an improved film for aerial reconnaissance
Part III. A determination of the characteristics such as, the value, contrast and color, which are necessary in aerial photographs in order to extract the maximum amount of information from monochromatic two-color and three-color aerial photographs
Part IV. Preliminary research of the suitability of techniques of exposing black and white films with alternating color filters producing stereo pairs with different tonal renditions for aerial reconnaissance,

Oceanography

Chesapeake Bay Inst., Johns Hopkins U. [Annapolis, Md.]
COMPUTATION OF THE LONGITUDINAL SALINITY DISTRIBUTION IN A DELAWARE ESTUARY FOR VARIOUS DEGREES OF RIVER INFLOW REGULATION, by D. W. Pritchard. Rept. on Contracts 14-16-008-517 and 14-16-008-546. Sep 59, 77p. Technical rept. XVIII; Reference 59-3.
Order from LC mi$4.50, ph$12.30 PB 144 712

This report presents the results of an evaluation of the probable longitudinal distribution of salinity as a function of time under four different seasonal flow patterns: (a) Modal Flow: a typical natural annual variation in river inflow; (b) Modified Case 1: low river flow regulated at 4,000 cfs (at Trenton); (c) Modified Case 2: low river flow regulated at 6,000 cfs (at Trenton); (d) Modified Case 3: low river flow regulated at 8,000 cfs (at Trenton). For each of these flow conditions the seasonal variation in salinity was computed as a function of position along the central axis of the estuary, under the assumption that the particular seasonal flow variation under consideration was repeated year after year. The method of computation is described in later sections of this report.

Narragansett Marine Lab., U. of Rhode Island, Kingston.
BIOLOGICAL PRODUCTIVITY PROJECT, by David M. Pratt. Rept. for 1 Jan-31 Dec 58 on Contract Nonr-396(03). [1958] 6p. Ref. no. 59-1.
Order from LC mi$1.80, ph$1.80 PB 145 209

Growth rates of the quahog, Venus mercenaria L., in Narragansett Bay were studied over a three-year period in relation to various environmental factors. It was shown that growth is not appreciably influenced by existing differences in current speed, dissolved oxygen content, or salinity of the bottom water. Growth is negligible below 10°C and increases with rising mean temperatures at least to 23°C. Temperature appears to impose an upper limit to the potential rate of growth. Comparisons of growth rates with phytoplankton concentrations suggested that small diatoms, either living or as detritus, are an important source of quahog nutrition in these waters. It was repeatedly demonstrated that growth is retarded in sediments with a high silt-clay content. This effect was studied in relation to the concomitant reduction in sediment permeability, the possible accumulation of inhibitory substances in muddy sediments, and the necessity for more frequent clearing of the animals' filtering apparatus.

Scripps Institution of Oceanography, U. of California, La Jolla.
MARINE MICROBIOLOGY, by Leslie Ralph Berger and Claude E. ZoBell. Annual progress rept., no. 11, 1 Jan-31 Dec 57, on Physiological Activities of Marine Bacteria, Contract N6onr-275(18). 1 Jan 58, 15p. 5 refs. SIO Reference 58-1; AD-156 539.
Order from LC mi$2.40, ph$3.30 PB 138 280

The effects of temperature and pressure were investigated on a glycosidase from a Streptomyces species. Glycosidase catalyzes the reaction between phenyl-β-D-2-deoxy-2-acetamidoglucoside and H_2O to yield phenol and N-acetylglucosamine. The rate at which phenol is liberated from the glycoside was measured from 1 to 1000 atm and between 15° and 60°C. At the lower temperatures, pressure decreased the reaction rate. At the higher temperatures, the increased pressure inhibited what appeared to be thermal denaturation of the enzyme system. A thermal gradient incubator block is described for use in bacteria growth studies

at 18 different temperatures simultaneously. Equilibrium constants are being determined of various ionic substances under pressure. Attemps are being made to develop better nutrient media for the enumeration of marine bacteria and to determine the specific growth requirements of pure cultures. The kinetics of bacterial growth is discussed. (See also PB 127 188)

Woods Hole Oceanographic Institution, Mass.
OPTICAL STUDIES OF PARTICULATE MATTER IN THE SEA, by Bostwick H. Ketchum and David H. Shonting. Technical rept. on Contract Nonr-2219(00). Feb 58, 29p. 8 refs. Reference no. 58-15.
Order from LC mi$2.70, ph$4.80 PB 138 326

A study of particulate matter distribution using the light-scattering photometer was made on the Cariaco Trench in the Caribbean Sea. Five successful lowerings of the light-scattering photometer were made; two near the center of the basin, one on the eastern sill, one on the western sill of the trench, and one in St. George's Harbor, Grenada, B. W. I. A discussion of the light-scattering data of the trench waters and its relationship to the dynamics of the water in the general area of the trench is presented. A comparison is made with the light scattering and Secchi disc readings of both the trench and the continental shelf waters. In addition, a theoretical relationship of scattering intensity with extinction coefficient is derived along with a comparison of turbidity measurements with other oceanographic data.

Physics of the Atmosphere

Arizona State Coll., Flagstaff.
THE ABUNDANCE OF ATMOSPHERIC CARBON MONOXIDE AT FLAGSTAFF, ARIZONA, by Arthur Adel. Scientific rept. HB-8 on Infrared Spectroscopy of the Sun, Moon, and Earth, Contract AF 19(604)2177 7 Sep 59, 23p. 3 refs. AFCRC-TN-59-466.
Order from LC mi$2.70, ph$4.80 PB 144 976

Thirty-four recorded measurements of the rotation-vibration line R(2) in the carbon monoxide band at 4.7 microns in the solar-telluric spectrum have been analyzed to ascertain the abundance of the gas above the Atmospheric Research Observatory at Flagstaff, Arizona.

Electrical Engineering Research Lab., U. of Texas, Austin.
A COMPARISON OF OBSERVED AMPLITUDES OF TROPOSPHERIC INDEX OF REFRACTION FLUCTUATIONS WITH THOSE CALCULATED FROM OBSERVED MEDIAN TRANSMISSION LOSSES, by Frank N. Edmonds, Jr. Rept. on Contract AF 19(604)2249. 15 Aug 58, 34p. 14 refs. Rept. no. 6-25; AFCRC-TN-58-378; AD-160 831.
Order from LC mi$3.00, ph$6.30 PB 138 249

In a companion report, a mathematical description of the index of refraction fluctuation field over Camp Carson, Colorado, was obtained from airborne refractometer measurements made on March 8 and 9, 1955. This representation was given in terms of the power spectra of the fluctuations as a function of frequency of the index fluctuations and of altitude. In the present report, a formula derived from scatter propagation theory and based on the measured fluctuation spectra, is given which relates radio transmission loss to the square of the amplitude of the refractive index fluctuations. Using this relationship, a value of the square of the index fluctuations was calculated which would account for the mean radio signal level on each of 14 National Bureau of Standards radio paths originating in the Camp Carson area.

Massachusetts Inst. of Tech., Cambridge.
THE MODES OF RELEASE OF AVAILABLE POTENTIAL ENERGY, by Barry Saltzman and Aaron Fleisher. Scientific rept. no. 1 on Planetary Circulations Project, Contract AF 19(604)4958. Oct 59, 21p. 13 refs. AFCRC-TN-59-629.
Order from LC mi$2.70, ph$4.80 PB 144 926

We have obtained the space spectra of the fields of vertical motion and temperature in the free atmosphere for February, 1959, and have estimated from these the conversions between available potential energy and kinetic energy as a function of wavenumber. (Author)

National Bureau of Standards, Boulder, Colo.
MEAN ELECTRON DENSITY VARIATIONS OF THE QUIET IONOSPHERE. I. MARCH 1959, by J. W. Wright and L. A. Fine. Feb 60, 53p. 5 refs. Technical note no. 40-1.
Order from OTS $1.25 PB 151 399-1

The CRPL has initiated a program for large-scale computation of electron density profiles from ionospheric vertical soundings. Scaling is performed at field stations permitting computation of hourly profiles at the central laboratory. These profiles are combined to form hourly mean quiet profiles for each station and month. The results of this program for one month are illustrated graphically. This report is the first of a series illustrating the electron density variations in the mean quiet ionosphere between latitudes 15°N and 50°N along the 75°W meridian. (Author)

Naval Research Lab., Washington, D. C.
THE RADIOACTIVITY OF THE ATMOSPHERE, by Irving H. Blifford. Interim rept. 15 Apr 53, declassified 28 Oct 57, 40p. 416 refs. NRL rept. 4118; AD-10 322.
Order from LC mi$3.00, ph$6.30 PB 145 154

A historical survey is presented of the radioactivity of the atmosphere. The radioactive constituents of the earth and air and their characteristics and distribution are discussed together with methods for their measurement.

Toronto U. (Canada).
FINAL REPORT, by J. A. Jacobs. Rept. on Contract AF 19(604)2147. 27 Sep 57, 4p. AFCRC TR-57-243; AD-146 857.
Order from LC mi$1.80, ph$1.80 PB 138 238

Three phases of work are reported briefly: a continuation of the work on magnetic storms; a study of geomagnetic pulsations; and a statistical study of some problems concerning the analysis of geomagnetic data. These three phases of the work are reported separately.

ENGINEERING

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 5. ENGINEERING. 375p.
Order from OTS $3.75 PB 161 137

Contents:
Civil engineering
Electrical engineering
Mechanical engineering (aeronautical and automotive included)
Ordnance engineering
(See also PB 151 498)

Stanford U., Calif.
FLOW-INDUCED VIBRATIONS IN HEAT EXCHANGERS, by B. J. Grotz and F. R. Arnold. Technical rept. no. 31 on Contract Nonr-225(23). Aug 56, 57p. 9 refs. AD-104 568.
Order from LC mi$3.60, ph$9.30 PB 145 452

Fluid-induced oscillations are familiar in the form of "galloping" transmission lines, waving smokestacks or periscope tubes, the humming of telephone wires, airplane wing flutter, pulsations of the atmosphere in forced-draft fire rooms under pressure, humming of boilers, "chugging" or "screaming" of rockets, familiar musical instruments--even the prosaic reciprocating steam engine. This report deals with a study of the oscillations established in a gas (air) flowing normal to banks of tubes in tube-in-line heat exchanger cores. A set of design factors is presented which may be applied in the design stage to prevent the vibrations which otherwise are humanly unbearable when of sonic frequency, also lead to mechanical component failures, and are accompanied by undesirable increases in flow friction factors.

Aeronautical Engineering

[Aerospace] Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DEVELOPMENT AND TEST OF A BALLOON-BORNE MANNED VEHICLE, by Richard L. Geer and John F. Rayfield. Rept. on High Dive. June 59, 47p. 3 refs. WADC Technical rept. 59-226.
Order from OTS $1.25 PB 161 092

Balloon borne vehicles are well suited for use as a means of lifting parachutists to very high altitude for test jumping. The design, fabrication, and testing of a vehicle, developed at the Wright Air Development Center for this purpose, are discussed in this report. Included are presentations of novel designs for a pressure-retaining hatch and an energy-absorbing parachute landing device. (Author)

Boeing Airplane Co., Seattle, Wash.
ADHESIVE METAL BONDING PROCESSES DEVELOPMENT, by Donald L. Poggi. Final rept. on Contract AF 33(600)25661. 15 Oct 56, 125p. Document D-14559-F; AD-119 945.
Order from LC mi$6.30, ph$19.80 PB 138 215

A high-speed airfoil component was developed as a bonded metal part. This part was first designed as a honeycomb-sandwich component incorporating a variably expanded core. This design was later abandoned in favor of a design making use of foamed resin to adjust the final size of the bonded component to its curing mold. It is concluded that this latter method of construction can be used in many aircraft components in lieu of conventional riveted construction at a saving in cost and weight.

California U., Los Angeles.
A PARAMETER TRACKING SERVO FOR ADAPTIVE CONTROL SYSTEMS, by M. Margolis and C. T. Leondes. Rept. on Contract AF 49(638)438. Aug 59, 35p. 10 refs. AFOSR-TN-59-917.
Order from LC mi$3.00, ph$6.30 PB 144 769

This paper describes one very general approach to the design of adaptive control systems. The particular systems considered are process adaptive. The dynamic characteristics of the physical process are determined by the parameter tracking servo. The parameters thus determined are used to program the process' controller. The parameter tracking servo is a closed loop self-adjusting system. It consists of the following elements: (1) the physical process, (2) the learning model, and (3) the adjusting mechanism. The learning model and the physical process are subjected to the same input signals. Their outputs are compared and the resultant error is fed to the adjusting mechanism where some function of this error is used to adjust the parameters of the learning model.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
A REVIEW OF CERTAIN FERROUS CASTINGS APPLICATIONS IN AIRCRAFT AND MISSILES, by John Varga, Jr., Rept. on Contract AF 18(600)1375. 18 Dec 59, 54p. 34 refs. DMIC rept. 120.
Order from OTS $1.50 PB 151 077

This report is a general summary of the application of steel castings to aircraft. Representative types of castings are illustrated and discussed. The problems of the aircraft manufacturer and castings

producer are presented. Future casting requirements and work that is in progress toward the increased use of castings are discussed. The purpose of this report is to present background information rather than the complete coverage required for a state-of-the-art report. (Author)

Equipment Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AIRCRAFT STRUCTURAL VIBRATION INDUCED BY JET NOISE, by Neal Granick and C. E. Thomas. Dec 56, 20p. 6 refs. WADC Technical note 56-514; AD-110 620.
Order from LC mi$2.40, ph$3.30 PB 145 344

The question as to whether aircraft structures respond closely with random jet noise is investigated. Vibration measurements were made at locations representing several types of structures in the B-52 airplane. It was found that continuous frequency vibration exists only on relatively light structures having large surfaces exposed to the jet source. However, on typical structures suitable for equipment locations, structural vibration was characterized by the presence of discrete frequencies with insignificant continuous frequency vibration. (Author)

Forest Products Lab., Madison Wis.
PRESSURE-SENSITIVE TAPE SUSPENSION SYSTEMS FOR AIRCRAFT PARTS IN SHIPPING CONTAINERS. PART II. EFFECTS OF ACCELERATED EXPOSURE ON TAPE PROPERTIES, by Arnold W. Voss. Rept. for Dec 57-Aug 58 on Finishes and Materials Preservation, Contract PO (33-600)53-4023. Oct 59, 35p. WADC Technical rept. 58-455, Pt 2.
Order from OTS $1.00 PB 161 362

Black pressure-sensitive tape backed with polyester film and reinforced with glass filaments was subjected to dynamic tests at room temperature and at -20°F. to determine its strength and toughness in tension and the shear strength and toughness of its bond to aluminum. Tests were made before exposure and after 4, 8, 12, 16, 20, and 32 cycles of accelerated exposure. Each cycle included 18 hours of ultraviolet light with alternate wetting and drying in a weatherometer, and 4 hours of freezing at below zero Fahrenheit. The initial effect of exposure was an improvement in these properties, but continued exposure beyond 12 cycles deleteriously affected the tensile strength and toughness of the tape. Principal conclusions are that suspension systems utilizing this tape have adequate weather resistance to withstand extended periods of outdoor exposure, and that the serviceability of the systems after extended exposure may be determined by visual inspection. (Author) (See also PB 151 945)

General Electric Co., Schenectady, N. Y.
HERMES B-1 AUTOMATIC PILOT, by A. B. Grafinger. Rept. on Project Hermes. Aug 50, declassified 17 Nov 58. 17p. Technical Information Series DF 50A0515.
Order from LC mi$2.40, ph$3.30 PB 144 947

The autopilot for the Hermes B-1 is a two axis system capable of stabilizing the missile attitude in roll and yaw during the desired portion of the flight. The roll control loop has fast response in order to minimize the effect of disturbances at separation, while the yaw channel has slow response, the cross-over frequency being well below the missile resonant frequency. (Author)

Institute of Flight Structures, Columbia U., New York.
AN ELASTO-PLASTIC THERMAL STRESS ANALYSIS OF A FREE PLATE, by Jerome H. Weiner. Rept. on Effect of Atomic Weapons on Aircraft, Contract AF 33(616)2071. June 55, 40p. 6 refs. WADC Technical note 55-512; AD-97 338.
Order from LC mi$3.00, ph$6.30 PB 145 145

The thermal stresses in a free plate of elasto-plastic material subjected to a varying heat input over one face are determined. A heuristic solution is first found by suitable modifications of the known elastic solution. It is then verified that the solution satisfies all the conditions of the appropriate uniqueness theorem and represents therefore the unique solution to the problem. Residual stresses are determined and found to depend markedly on the peak magnitude of the heat input. (Author)

Institute of Flight Structures, Columbia U., New York.
THERMAL STRESS ANALYSIS FOR AIRCRAFT STRUCTURES. PART II: BIBLIOGRAPHY, by Bruno A. Boley, Jerome H. Weiner, and Irwin S. Tolins. Rept. on Effects of Atomic Weapons on Aircraft, Contract AF 33(616)2071. Nov 55, 39p. 444 refs. WADC Technical rept. 56-102, Pt. 2; AD-97 340.
Order from LC mi$3.00, ph$6.30 PB 145 146

This report presents a chronological listing of the literature pertaining to thermoelasticity from the beginnings of this subject in the early nineteenth century to the present. A short summary is given of some of the works, particularly those of interest in aircraft stress analysis. (Author)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DEVELOPMENT OF LIGHTWEIGHT ALUMINUM CRATES FOR BULKY LOW DENSITY ITEMS, by Warren Hypes. Rept. for Jan 57-Mar 59 on Finishes and Materials Preservation. Sep 59, 40p. WADC Technical rept. 59-297.
Order from OTS $1.00 PB 161 364

Formed aluminum channels were used in assembling crates for lightweight, bulky airframe components. The crates passed the Level A rough handling requirements of Specification MIL-P-7936. In addition to possessing the required strength, the channels are reusable, thus a modular system of crate components could be developed. Use of the aluminum crates will provide a means for considerable reduction in tare weight when used as shipping containers for airframe components. The use of the aluminum channels also appears to be economical. (Author)

Michigan U., Ann Arbor.
AN INVESTIGATION OF FLIGHT EQUATION REQUIREMENTS FOR SIMULATORS OF AIRCRAFT UP TO MACH 3.5, by R. M. Howe. Rept. on Contract AF 33(616)2839. Mar 57, 45p. 8 refs. WADC Technical note 57-144; AD-210 834.
Order from LC mi$3.30, ph$7.80 PB 145 343

This report summarizes the results of an investigation of the computer-section requirements of flight simulators for aircraft up to Mach 3.5 in performance capabilities. Included in the report are the flight equations which, it is felt, represent the best mechanization of the required computations. The source, expected range in value, effect on the aircraft response, and estimated tolerance requirements for the lateral and longitudinal stability derivatives are presented. The effect of inertia coupling terms is discussed, as well as recommendations regarding which terms should be included in the simulator. A survey of the effect of aerodynamic heating and the probable simulator requirements which it may introduce is given. Finally, the expected dynamic performance range, both in regard to limiting velocities and accelerations, and in frequencies, is presented.

National Research Labs., Ottawa (Canada).
FLIGHT TESTS OF AN EXPERIMENTAL HELICOPTER ROTOR BLADE ELECTRICAL DE-ICER, by J. R. Stallabrass. Nov 59, 58p. 6 refs. Aeronautical rept. LR-263.
Order from LC mi$3.60, ph$9.30 PB 144 886

A sprayed metal in resin rotor blade de-icing mat employing the spanwise shedding principle was tested on a helicopter in flight under simulated icing conditions. The results showed that, despite shortcomings in the design of the heater elements used, this method of de-icing is practical and can result in clean, efficient shedding of ice. In particular, the negligible increase in vibration resulting from asymmetric shedding makes the spanwise shedding method attractive for small helicopters having limited electrical generating capacity. (Author)

Naval Air Test Center, Patuxent River, Md.
ANALYSIS OF TURBOJET ENGINE THRUST IN FLIGHT, by W. J. Hesse. Rept. on Proj. TED-PTR-PP-343. 18 July 51, declassified. 268p. 80 refs. NATC Serial TPTO3-1-51.
Order from LC mi$11.10, ph$44.10 PB 145 306

An F2H-1 airplane was extensively instrumented for the purpose of evaluating several methods of measuring gross and net thrust of a turbojet engine in flight. The theory and test results of 4 methods of gross thrust measurement are presented, and it is shown that several methods produce satisfactory results. The results of the net thrust data are compared to the airplane drag data as obtained from the same airplane by measuring the accelerations in a number of power off dives. It is shown that a satisfactory correlation exists between the flight thrust and flight drag data.

Pennsylvania State U. Coll. of Engineering and Architecture, University Park.
A STUDY OF TURBINE PERFORMANCE IN A NONSTEADY FLOW FIELD, by D. F. White. Final rept. on Contract Nonr-656(16). Feb 59, 21p.
Order from LC mi$2.70, ph$4.80 PB 145 213

The performance of a single stage axial flow turbine which is supplied with energy in the form of finite amplitude gas pressure waves was analyzed by means of a wave diagram technique based on the method of characteristics. The major portion of the analytical work is concerned with the case of full admission, and numerical solutions for given initial conditions can be obtained with the aid of a program written for the IBM 704 EDPM. Test data under actual nonsteady flow conditions were obtained from two experimental turbines. Within the range of validity of the assumptions used in the wave diagram analysis, the agreement between experimental and calculated results is excellent. Some very approximate calculations were made on the nonsteady effects due to partial admission, the results of which show order of magnitude agreement with test data. (Author)
(See also PB 142 226)

United Aircraft Corp., East Hartford, Conn.
EFFECT OF GEOMETRIC PARAMETERS ON WEIGHT OF SEVERAL SUPERSONIC WINGS, by Robert F. Kahn. 16 Apr 51, declassified, 30p. 3 refs. Rept. no. R-72014-9; NEPA 1822; ATI-200 933.
Order from LC mi$2.70, ph$4.80 PB 137 451

Wichita U. School of Engineering, Kans.
TWO-DIMENSIONAL CIRCULATION CONTROL TESTS ON AN NACA 23015 AIRFOIL EQUIPPED WITH A SEALED AND SLOTTED FLAP TO DETERMINE JET MOMENTUM LOSS OVER THE FLAP. Supplementary rept. by Robert K. Wattson, Jr. and Keith R. David. Dec 58, 74p. 1 ref. Engineering rept. no. 311-1; FAMD rept. no. R246A-003.
Order from LC mi$4.50, ph$12.30 PB 145 042

See also PB 142 036

Chemical Engineering

American Potash and Chemical Corp., Henderson, Nev.
INDUSTRIAL PREPAREDNESS STUDY ON SYNTHETIC BATTERY GRADE MANGANESE DIOXIDE, by Jerome T. Muench. Quarterly progress rept. no. 6, 29 Sep-29 Dec 57, on Contract DA 36-039-sc-72715. [1958] 11p. 3 refs. AD-162 573.
Order from LC mi$2.40, ph$3.30 PB 137 821

Detailed drawings of one ton a day pilot plant. Battery test results indicate the chemical manganese dioxide produced by the sodium chlorate-manganous sulfate process is of military battery grade quality. (See also PB 130 743)

Applied Science Labs., Inc., State College, Pa.
RESEARCH ON SALT WATER PURIFICATION BY FREEZING, by Arthur Rose and Thomas B. Hoover. Rept. on Contract 14-01-001-69. Sep 55, 58p. Saline Water Research Development progress rept. no. 7.
Order from OTS $1.50 PB 161 382

The experiments of this project have shown that ice made from saline solution always consists of crystals of minute size, and that a mass of such crystals necessarily retains in its interstices a comparatively great volume of mother liquor which cannot be separated by ordinary draining or filtering, is only partially separated by centrifuging, and is displaced only slowly and inefficiently by ordinary washing. As a result of these experiments, the most promising method of making a sharp separation of salt from the ice appears to be countercurrent contacting.

Badger, W. L., and Associates, Inc., Ann Arbor, Mich.
CRITICAL REVIEW OF LITERATURE ON FORMATION AND PREVENTION OF SCALE. Rept. on Contract 14-01-001-99. July 59, 51p. 143 refs. Office of Saline Water Research and Development progress rept. no. 25.
Order from OTS $1.50 PB 161 399

This report is based primarily on a comprehensive survey of literature published since 1930 and unclassified reports put out by various research organizations and governmental laboratories. The literature review resulted in the preparation of some 900 abstract cards, which are on file at the Office of Saline Water.

Badger Mfg. Co., Cambridge, Mass.
RESEARCH CONTINUATION OF BADGER-HICKMAN CENTRIFUGAL DISTILLATION TESTING ON UNIT NUMBER 4. Rept. on Contract 14-01-001-81. Mar 57, 80p. Office of Saline Water Research and Development progress rept. no. 15.
Order from OTS $2.00 PB 161 390

The Badger-Hickman still is relatively insensitive to certain changes in feed rate or load rate, as far as heat transfer coefficient is concerned, and, thus is largely self managing. Contamination by partially consensable nonaqueous vapor or permanent gas is exceedingly repressive of distillation, but, simple precautions in design and operation obviate this hazard. The No. 4 still has conformed and extended the performance characteristics of the previous centrifugal phase barrier stills. A still with a rotor 4.5 ft. diameter has a steady state operating heat transfer coefficient at least 4 times the average of present commercial vapor compression stills. The No. 4 stills can operate for 200 hours and evidently much longer periods on sea water without serious loss of efficiency at temperatures of 150°F. and below.

Badger Mfg. Co., Cambridge, Mass.
RESEARCH ON AND DEVELOPMENT OF BADGER-HICKMAN CENTRIFUGAL DISTILLATION TECHNIQUES AND EQUIPMENTS. Rept. on Contract 14-01-001-65. Nov 56, 98p. Saline Water Research and Development progress rept. no. 12.
Order from OTS $2.25 PB 161 387

The development was continued of a radically new type of vapor-compression distillation apparatus for saline water, based on the principle of high-velocity flow of thin films of water over the heating surfaces at temperatures below the scale forming limit. A small machine with 18 inch rotors was constructed and operated successfully for over 300 consecutive hours on sea water to demonstrate heat transfer efficiency. A larger experimental machine, with 5 foot diameter evaporator disks was then constructed and operated on both sea water and tap water in order to extend and confirm the information obtained on the smaller machines. This research and development work has been directed toward reducing evaluation of variables with respect to unit design and operation, such as effect of heat transfer element shape and movement, and the effects of operating temperatures, pressures and rates of evaporation. As a result of this effort, a No. 5 unit of 25,000 gpd capacity has been designed and is under development. (Author)

Battelle Memorial Inst., Columbus, Ohio.
AVAILABILITY OF GEOTHERMAL ENERGY FOR THE DEMINERALIZATION OF SALINE WATER, by J. C. Bell, R. C. Crooks and others. Rept. on Contract 14-01-001-89. July 59, 63p. 53 refs. Office of Saline Water Research and Development progress rept. no. 27.
Order from OTS $1.75 PB 161 400

Cost estimates for a so-called "average" example of salt-water evaporation with geothermal energy (i.e. average thermal gradient, 20,000 foot vertical shaft in granite; 1 foot in diameter) resulted in a calculated cost of over $28 per 1000 gallons of fresh water. The cost of the hole represented about 75 per cent of the total estimated investment and the method of cost estimating used reflected the high investment in terms of various operating costs. Even if the hole were available free of charge, the calculated water cost would still be between $5 and $10 per 1000 gallons. Unusual thermal gradients and a free hole conceivable might bring this cost below $1 per 1000 gallons, but a rather unique set of circumstances ("free" hole, high gradient, large cooling water supply) would be required to produce even such a situation. A similar estimate for conversion of geothermal energy into electric power showed an estimated cost of 66 cents per kwh. The cost of the hole represented about two-thirds of the estimated investment. A "free" hole thus would bring the estimated power cost into the 20 cents per kwh range. The effect of unusual gradients would have to be even greater here than in the evaporation case to reduce further the cost into the range of today's U. S. power costs. (Author) (See also PB 161 392)

Battelle Memorial Inst., Columbus, Ohio.
RESEARCH INVESTIGATIONS OF MULTIPLE-EFFECT EVAPORATION OF SALINE WATERS BY STEAM FROM SOLAR RADIATION, by B. A. Landry. 17 June 53, 6p, Summary of Office of Saline Water Research and Development progress rept. no. 2, Dec 53, out-of-print.
Order from OTS $0.50 PB 161 377

Research investigations were conducted of multiple-effect evaporation of saline waters by steam from solar radiation. The work consisted of the preparation of preliminary designs, of the calculation of performance and of estimates of gross costs of water production. The information obtained is of use in estimating (1) the technical possibility of substituting solar energy for fuel energy for raising the steam required to operate a multiple-effect evaporator to produce pure water from saline waters, (2) how far such a plant might be made automatic in its operation, and (3) operating and maintenance costs including fixed charges and additional energy requirements.

Battelle Memorial Inst., Columbus, Ohio.
THE ZONE-PURIFICATION PROCESS AS A METHOD OF PREPARATION OF PORTABLE WATER FROM SEA WATER, by S. E. Miller, R. C. Himes, and H. L. Goering. Rept. on Contract 14-01-001-80. Jan 58, 16p. Office of Saline Water Research and Development progress rept. no. 17.
Order from OTS $0.50 PB 161 392

At the outset of this investigation, a number of process parameters were recognized as possible conditions influencing the effectiveness of zone refining and directional freezing of salt water. Among these parameters, temperature in the freezing compartment, rate of crystallization, solution concentration and agitation were found to influence the efficiency of the process. In an effort to clarify certain anomalies in the results of earlier studies conducted under this contract, apparatus was devised in which visual observations could be made directly and continuously in the freezing system. Studies (microscropic and analytical) of the nature of ice laid down from salt solutions at various rates and concentrations and under varying degrees of agitation have shown that, while good clear ice may be crystallized at reasonably high rates (2 inches per hour) from dilute solutions, the rate at which such ice may be grown is suppressed as solution concentration is increased (other conditions being held constant). In experiments performed to date, taking these factors into consideration qualitatively, it has been found possible regularly to remove with a single directional freeze 99.9+per cent of salt from solutions containing up to 20 grams per liter. In the range 20 to 30 grams per liter, 97.5 per cent removals are effected, and in the range 30 to 70 grams per liter, about 82 per cent removal has been made. In directional freezing experiments on sea water it was found possible to prepare excellent drinking water (less than 50 ppm total salt concentration) in a two-stage program. The results indicate that with some additional refinement it may be possible to accomplish the task in a single stage. (See also PB 161 377)

Bjorksten Research Labs., Inc., [Madison, Wis.]
DEVELOPMENT OF PLASTICS SOLAR STILLS. Final rept. for July 57-Oct 58 on Contract 14-01-001-64. Feb 59, 34p. Office of Saline Water Research and Development progress rept. no. 24.
Order from OTS $1.00 PB 161 398

Contents
Development of plastic solar still design: triangular plastic solar still; "standard" greenhouse-type plastic solar still; air inflated solar still; tubular plastic solar still; polyethylene spiral solar still; wire-supported triangular plastic solar stills; suspended envelope type plastic solar still; Experiments with plastics for use in plastic solar still construction: results of tests with "standard" greenhouse-type stills; performance data, suspended envelope stills; resistance of films to solar radiation; transmissivities of plastic films.

Bureau of Reclamation, Washington, D. C.
POTENTIAL USE OF CONVERTED SEA WATER FOR IRRIGATION IN PARTS OF CALIFORNIA AND TEXAS. Apr 54, 27p. Saline Water Research and Development progress rept. no. 3.
Order from OTS $0.75 PB 161 378

This report is a rough inventory of arable lands and other potential uses of water which might conceivably benefit from development of a low-cost method of sea water conversion. There are identifiable estimated potential uses for water, over and above those which can be supplied from natural local sources, totalling as much as 21,000,000 acre-feet annually in southern California and Texas. Of this amount, over 8,000,000 acre-feet could be used by direct pumping of converted sea waters onto the arable lands within reasonable heights above or distance from the ocean. Some 3,250,000 acre-feet of converted sea water could be used directly by municipalities or industries near sea level. Releasing the water which is now being imported or is proposed to be imported to meet those needs would permit almost 10,000,000 acre-feet of that water to be used on other lands which may be beyond the economic reach of direct service with converted sea water.

Carrier Corp. [Syracuse, N. Y.]
DEVELOPMENT OF A DIRECT-FREEZING CONTINUOUS WASH-SEPARATION PROCESS FOR SALINE WATER CONVERSION, by C. M. Bosworth, S. S. Carfagno, and D. J. Sandell. Rept. for 1 Aug-15 Oct 57 on Contract 14-01-001-86. Jan 59, 94p. Office of Saline Water Research and Development progress rept. no. 23.
Order from OTS $2.25 PB 161 397

The experimental program has progressed to the point that ice has been produced in the freezer at design rate. Product ice of the freezer-separation column combination has a salt concentration of less than 500 ppm. Operational characteristics of the equipment have yet to be optimized. The cost of producing fresh water from sea water by the direct freezing, vapor compression, wash separation process is less than presently available distillation processes. This cost has been estimated to be $1.14 per 1,000 gallons, using the economic analysis system suggested by the United States Department of the Interior. If waste steam is available, the absorption refrigeration process is estimated at $1.02 per 1,000 gallons. (Author)

Carrier Corp. [Syracuse, N. Y.]
FURTHER DEVELOPMENT OF A DIRECT-FREEZING CONTINUOUS WASH-SEPARATION PROCESS FOR SALINE WATER CONVERSION, by C. M. Bosworth, S. S. Carfagno and others. Rept. for 1 Sep-30 Nov 58 on Contract 14-01-001-86. July 59, 82p. Office of Saline Water Research and Development progress rept. no. 32.
Order from OTS $2.25 PB 161 403

The experimental equipment constructed in 1957 has evaluated the feasibility of a direct freezer and of a wash separation column. This equipment produced ice, which when melted contained less than 500 ppm of dissolved solids, at the design rate of 100 lb. of ice per hour or 300 gallons fresh water per day. Recent modifications have resulted in greater capacity or about 400 gpd with an acceptable amount of wasted wash water. The objective of the experimental program during 1958 was the determination of operational variables of both the freezer and the column in order to design a pilot plant and this objective has been met. A summary of the experiments to produce more ice is included. Discussions of the correlations of the transfer rates in the separation column are also presented. A pilot plant has been designed to produce 15,000 gpd of fresh water from sea water. This plant utilizes an absorption refrigeration machine for water vapor removal. (Author) (See also PB 161 397)

Dodge, Barnett F. and Eshaya, Allen M.
ECONOMIC EVALUATION STUDY OF DISTILLATION OF SALINE WATER BY MEANS OF FORCED-CIRCULATION VAPOR-COMPRESSION DISTILLATION EQUIPMENT. Rept. on Contract 14-01-001-101. [1958] 194p. 38 refs. Office of Saline Water Research and Development progress rept. no. 21.
Order from OTS $3.00 PB 161 395

A vapor-compression cycle in which the brine is in forced circulation within the tubes and the steam condenses in dropwise manner on the outside of the tubes has been studied in order to determine the optimum combination of the important variables. To decrease the rate of scale formation, the hot brine is flashed in a separate chamber and no boiling occurs in the heat exchanger tubes. The investigation has covered the following values of the independent plant parameters: (1) Capacity of 10^5, 10^6, 10^7 gpd. (2) Maximum brine temperatures of 160°F and 212°F. (3) Tube sizes of 3/4", 1", 1 1/4", and 1 1/2" O. D., 16 BWG (4) Scaling and condensation heat resistance. (a) $h_s = \infty$ and $h_c = 13,000$ Btu/hr-°F-ft^2 (Condition I) (b) $h_s = 5000$ and $h_c = 9000$ Btu/hr-°F-ft^2 (Condition II)

Florida U., [Gainesville].
WATER AND ION FLOW THROUGH IMPERFECT OSMOTIC MEMBRANES, by Ernest Joseph Breton, Jr. Rept. on Contract 14-01-001-79. Apr 57, 74p. 44 refs. Office of Saline Water Research and Development progress rept. no. 16.
Order from OTS $2.00 PB 161 391

Contents:
Theory for the semipermeability of cellulose acetate
Experimental support of theory based upon semi-permeability determinations
Electrical measurements to support theory
Mechanism for loss of membrane semipermeability
Recommendations for an improved membrane

Griscom-Russell Co., Massillon, Ohio.
RESEARCH ON AND ANALYSIS OF SINGLE-EFFECT LOW TEMPERATURE FLASH EVAPORATION PROCESS. Rept. on Contract 14-01-001-90. [1955] 102p. 7 refs. Office of Saline Water Research and Development progress rept. no. 18.
Order from OTS $2.50 PB 161 393

Low temperature flash evaporation of warm saline waters is theoretically sound, technically feasible, and proven by actual installations which have been operating for a number of years. With a 30° total temperature difference between the incoming warm water and the incoming cooling water, cost estimates using the Office of Saline Water standardized procedure show that water could be produced by this process for approximately $1.20 per thousand gallons in a plant designed to produce 10,000,000 GPD, and for approximately $1.75 per thousand gallons for a plant designed to produce 100,000 GPD. The cost of water produced by such plants at a total temperature difference of 15° between the incoming warm water and the outgoing cold water would be very close to double the corresponding costs for 30°F The quantity of air which must be removed from the evaporators by vacuum pumping equipment was determined experimentally with a precision sufficient for purposes of selecting pumping equipment.

Ionics, Inc., Cambridge, Mass.
DESIGN, CONSTRUCTION, FIELD TESTING, AND COST ANALYSIS OF AN EXPERIMENTAL ELECTRODIALYSIS DEMINERALIZER FOR BRACKISH WATERS, by J. P. Dankese, T. A. Kirkham and others. Rept. on Contract 14-01-001-66. Dec 56, 176p. Office of Saline Water Research and Development progress rept. no. 11.
Order from OTS $3.00 PB 161 386

The purpose of the tests was primarily to determine the effects of operating the process under field conditions, to provide estimates of the cost of demineralizing brackish waters on a large scale, and as a means of planning further needed research in this field. An experimental apparatus capable of reducing the salinity of a brackish water containing 4,000 ppm dissolved solids to 350 ppm at a rate of 1,000 gph was built and tested. Two tests were made. The first, of six months duration, was in Arizona where the unit was operated on an irrigation water supply containing about 4,000 ppm dissolved salts. The second, of three months duration, was in Miller, South Dakota on a municipal water supply from a deep well which contained about 2,000 ppm dissolved salts. Both of these field tests demonstrated that the electrodialysis process could be used to reduce the salinity of those waters to below 350 ppm. (See also PB 161 376)

Ionics, Inc., Cambridge, Mass.
RESULTS OF SELECTED LABORATORY TESTS OF AN IONICS DEMINERALIZER, by N. W. Rosenberg, T. A. Kirkham and others. Rept. on Contract 14-01-001-52. Apr 54, 78p. Saline Water Research and Development rept. no. 1.
Order from OTS $2.00 PB 161 376

An electrical process has been developed for the demineralization of water, using the special properties of ion-transfer membranes. Estimates of the costs of this process have been made for the treatment of typical brackish waters. These costs vary widely, depending on the salt content of the raw water. The waters studied under the present contract and the projected costs of mass-produced installed units to treat 75,000,000 gal/day (10 acre ft/hr) are included. It is the opinion of Ionics, Incorporated, that sufficient promise has been shown by the membrane demineralizer to warrant field operation of a larger installation to confirm the estimates of this report.

Koenig, Louis, Research, San Antonio, Tex.
DISPOSAL OF SALINE CONVERSION BRINES: AN ORIENTATION STUDY, by Louis Koenig. Rept. for 11 Dec 56-18 Apr 57 on Contract 14-01-001-92. 1958, 129p. 1 ref. Office of Saline Water Research and Development progress rept. no. 20.
Order from OTS $2.75 PB 161 394

This report constitutes a preliminary exploration of the problem of disposing of waste salts, usually in the form of brine, resulting from the conversion of saline waters to fresh water. So far as known, this is the first attempt that has been made to assay the order of magnitude of these waste disposal costs. As a first attempt the result is definitely intended as a bird's-eye view which will allow selection of favorable areas for more intensive study. The cost estimates are of a "huddle" estimate type, usually a one man huddle. At the same time it was desired to present a general method by which the technical and economic aspects of any particular disposal method could be worked out. For that reason the report contains a number of correlations allowing extrapolation and interpolation which would not ordinarily be found in cost estimating for a specific process or a specific location.

Löf, George O. G.
DEMINERALIZATION OF SALINE WATER WITH SOLAR ENERGY, by George O. G. Löf. Rept. on Contract 14-01-001-55. Aug 54, 96p. 73 refs. Saline Water Research and Development progress rept. no. 4.
Order from OTS $2.25 PB 161 379

About 30 proposed methods for demineralizing saline water with solar energy have been analyzed from the engineering and economic standpoints, and probable minimum costs for producing fresh water by these methods have been estimated.

Löf, George O. G.
SOLAR DISTILLATION OF SEA WATER IN THE VIRGIN ISLANDS, by George O. G. Löf. Rept. on [Contract 14-01-001-55]. Feb 55, 42p. 7 refs. Saline Water Research and Development progress rept. no. 5.
Order from OTS $1.25 PB 161 380

It was found that under the average solar conditions which prevailed during the period of the tests, which corresponded very closely to normal winter weather in the Caribbean Islands, the distiller operated at about 35 percent solar utilization efficiency, resulting in a daily yield of about 0.6 pound of water per square foot of evaporator pan. Under the best sunshine conditions, approximately 1.0 pound of water was obtained per square foot per day, at an efficiency only slightly higher than 35 percent. The above values are only about half those which might be considered ideal for this type of equipment under the best operating conditions. The difference between the actual and the ideal performance is accounted for in the various heat losses which occurred. Improvements in distiller construction and operation would result in substantial reduction of these losses, and an average winter efficiency of about 55 percent should be obtainable in a large installation. This efficiency would permit the average daily production of 1 pound of water per square foot of evaporator surface, corresponding to a requirement of about 85,000 square feet for an average daily production of 10,000 gallons of water. (See also PB 161 379)

Murphy, George W.
THE MINIMUM ENERGY REQUIREMENTS FOR SEA WATER CONVERSION PROCESSES, by George W. Murphy, Robert C. Taber, and H. H. Steinhauser. Rept. on Contract 14-01-001-58. Apr 56, 79p. 10 refs. Office of Saline Water Research and Development progress rept. no. 9.
Order from OTS $2.00 PB 161 384

Chapter 1 deals with ultimate idealizations of saline water conversion processes, using a classical thermodynamic approach. The value of this approach is to provide a convenient classification of the various method based on thermodynamic criteria, to illustrate the fact that the thermodynamic minimum work done is the same regardless of method, and to provide a first approximation to the energy requirement as a basis for dealing with real processes. The aim of the remaining work is to furnish as good a second approximation to the actual minimum energy requirement as possible, taking into account the rate phenomena which are a part of every method. Although the groundwork has been laid for many methods, calculations have been performed for only two, compression distillation and the electrical membrane process. Some idealization is still present in the results of these calculations, but less than in those of Chapter 1. In both cases the practical minimum energy requirement is estimated to be about four times the thermodynamic minimum, exclusive of losses in energy conversion devices and of water transport requirements. This can be regarded as a crude second approximation, compared to the exact first approximation of the thermodynamic minimum. It is difficult to gauge at this point how much a further reduction in idealization will raise the energy value, but further work along this line is clearly in order. It is unrealistic to believe that other methods presently under investigation or yet to be devised can

operate with a lower "practical minimum", although it is still theoretically possible. The expected degree of generality in applying the thermodynamic equations of motion to all methods has not yet been achieved, but further progress in this line is to be expected. (Author)

Murphy, George W.
THE OSMIONIC PROCESS, by George W. Murphy. Rept. on Contract 14-01-001-58. 1957, 75p. 4 refs. Office of Saline Water Research and Development progress rept. no. 14.
Order from OTS $2.00 PB 161 389

An experimental program was initiated in 1954 on a new approach to saline water demineralization which uses as a power source (osmotic power) the free energy difference between concentrated brine and a saline water of lower concentration; the energy conversion principle is based on the properties of an assembly of permselective membranes. Experimental devices have been constructed and successfully operated over the concentration range 1,000-30,000 ppm NaCl for the purpose of obtaining basic equilibrium and rate data. In this report, the basic theory for the simplest or single-effect osmionic cell is developed first, followed by an extension of the theory to include multiple-effect cells and multiple-stage operation. Calculations are presented for typical cases. (See also PB 161 384)

Naval Research Lab., Washington, D. C.
EXPERIMENTAL VALVELESS PULSEJET DIESEL-FUELED FOG GENERATOR, by M. A. Persechino. Final rept. 22 Dec 59, 17p. 7 refs. NRL rept. 5414.
Order from LC mi$2.40, ph$3.30 PB 143 016

A valveless pulsejet fog generator has been developed and tested at NRL under a program sponsored by the Bureau of Ships. The unit consists of a ducted 3-1/2-in. valveless pulsejet engine capable of producing oil-droplet particle sizes within the operational range of 0.6 to 0.7 micron in diameter and a vaporizing capacity of 55 gph (using fog oil type SGF-2, MIL-F-12070A). The burner and vaporizing assembly without controls weighs approximately 65 lb fully insulated. The valveless pulsejet fog generator is capable of vaporizing a variety of fogging oils and offers the following possible advantages over existing units: (1) Low manufacturing costs; (2) Little or no carbon deposition in the vaporizing chamber; (3) Operation with no moving parts, thus promoting long service life with little or no maintenance; (4) Ability to operate on a variety of fuels, including the more viscous fuels, including the more viscous fuel oils; (5) Ability to operate at part load; (6) Resistance to high temperatures caused by the absence of the cooling effect from oil vaporization during starting and securing; (7) Simplicity. With little further development and modification, larger capacity units can be made available for operational purposes either by paralleling the present unit in multiple ducted pairs or by scaling up to larger sizes. Development work along these lines was terminated upon exhaustion of allocated funds. (Author)

New York U. Coll. of Engineering, N. Y.
NEW AND IMPROVED METHODS FOR LOWER COST SOLAR DISTILLATION, by Maria Telkes. Rept. on Contract 14-01-001-68. Aug 59, 40p. 3 refs. Office of Saline Water Research and Development progress rept. no. 31.
Order from OTS $1.00 PB 161 402

Further design and experimental work with flat, tilted single effect stills resulted in definite improvements. Most of the heat carried away by the outflowing brine could be recovered with a heat exchanger tube and used to preheat the feed water, resulting in an increased water yield of 10 to 15 percent on clear summer days, and considerably larger improvements on cloudy or partly cloudy days. Automatic regulation of the feed water was achieved by using solar radiation to operate a capillary flow rate governor. Experimental results indicated that temperature increase changes the fluidity of the feed water, and in this way increases the feeding rate in proportion to solar radiation intensity. Another simple feeder has been designed which changes the feeding rate by increasing the water-head. Several devices have been built and tested to determine the possibility of using the heat of condensation of the distillate. The results indicated that it is not possible to recover more heat from the condensate than is needed to preheat the feed water. Circulation of air within the still similarly failed to increase the water yield. Larger multiple effect stills were built and tested, using electrical heating during the sunless colder months. The use of aluminum sheet produced results comparable to those obtained previously with Mylar films. Perfect vapor-tight arrangement is essential, heat insulation must be used. Solar energy operated multiple effect stills were designed and tested. (Author) (See also PB 161 388)

New York U. Coll. of Engineering, N. Y.
RESEARCH ON METHODS FOR SOLAR DISTILLATION, by Maria Telkes. Rept. on Contract 14-01-001-68. Dec 56, 78p. 4 refs. Office of Saline Water Research and Development progress rept. no. 13.
Order from OTS $2.00 PB 161 388

The objective of this investigation is to reduce as much as possible the total cost of sustained conversion of sea, or other saline water, to fresh water in large quantities, by solar energy, by conceiving and developing new methods and improving existing methods, or both. Tilted flat type solar stills have been developed and compared with roof-type stills. The tilted stills had approximately 26 to 50 percent greater yield during the summer months. This was definitely in excess of the estimate, based on increased solar energy received by the tilted surface.

New York U. Coll. of Engineering, N. Y.
SOLAR STILL CONSTRUCTION, by Maria Telkes. Rept. on Contracts 14-01-001-68 and 102. Aug 59, 26p. Office of Saline Water Research and Development progress rept. no. 33.
Order from OTS $0.75 PB 161 404

Contents:
The amount of solar radiation and water yield
Structural components of the single effect solar still

Glass covered flat, tilted solar still
Operation of the still
Multiple effect still
Structural components of the multiple effect still
Operation of the multiple effect still
(See also PB 161 402)

[Office of Saline Water] Washington, D. C.
DEMINERALIZATION OF SALINE WATERS: A PRELIMINARY DISCUSSION OF A RESEARCH PROGRAM WITH AN OUTLINE AND DESCRIPTION OF POTENTIAL PROCESSES AND A BIBLIOGRAPHY. Oct 52, 70p. 217 refs.
Order from OTS $1.75 PB 161 373

A compendium of existing and potential separation processes, phenomena, and energy sources with discussion and literature references.

[Office of] Saline Water, Washington, D. C.
GRANTS AND CONTRACTS FOR SCIENTIFIC RESEARCH. GUIDES FOR THE SUBMISSION OF RESEARCH AND DEVELOPMENT PROPOSALS. Nov 52, 7p.
Order from OTS $0.50 PB 161 374

Public Law 448 is an act to provide for research into and development of practicable low-cost means of producing from sea water, or other saline waters, water of a quality suitable for agricultural, industrial, municipal, and other beneficial consumptive uses on a scale sufficient to determine the feasibility of the development of such production and distribution on a large-scale basis, for the purpose of conserving and increasing the water resources of the Nation. Two general types of proposals will be considered. One type relates to research and development work for which it is possible and desirable to define the objectives and procedures only in general terms. In the second type objectives, procedures and expected results can be determined in advance. Either type may take the form of a grant or a contract.

Office of Saline Water, Washington, D. C.
A STANDARDIZED PROCEDURE FOR ESTIMATING COSTS OF SALINE WATER CONVERSION. Mar 56, 50p. 20 refs.
Order from OTS $1.25 PB 161 375

This volume presents a standardized procedure for making initial cost estimates for demineralization of saline waters by various processes. It is believed that use of this procedure will provide sufficiently accurate cost estimates for initial economic comparisons between processes. More detailed estimates will become necessary for processes in advanced stages of development. The procedure is primarily for the use of the Office of Saline Water, its consultants, and its present and prospective cooperators for comparing processes and determining feasibility of conducting research and development work.

Purdue U., Lafayette, Ind.
AN ANNULAR JET PUMP, by Werner H. Haak and Frederick Vrátný. Rept. on Contract AF 18(603)45. Oct 58, 4p. 2 refs. AFOSR-TN-58-937; AD-205 089.
Order from LC mi$1.80, ph$1.80 PB 137 842

A two stage pump was designed with the idea that the upper stage jet would aid the diffusion of mercury into the upper trapping mechanism without serious reduction of pumping speed. On testing the design the extent of mercury diffusion was significantly reduced over the single stage pump (a thin mirror was produced in an eight hour period), and the consumption of liquid nitrogen was likewise appreciably diminished (about 5 liter in a 10 hour period).

Rochester U., N. Y.
ADHESION OF PROTECTIVE COATINGS TO METALS BY TENSILE TESTS, by Gouq-Jen Su, Thomas R. Faucett, and Bogdan Gumowski. Rept. on Contract AF 18(600)1187. Sep 59, 71p. 37 refs. AFOSR-TR-59-172.
Order from LC mi$4.50, ph$12.30 PB 145 362

The results were obtained by tensile tests with butt joints, using steel, brass, and aluminum as the metal substrates, and various commercial resins and coating formulations. The following factors which affect adhesion are discussed: Effect of loading rate on measured bond strength. Surface treatment effects on adhesion to aluminum. Bond strength as a function of bond thickness. Bond strength as a function of curing time for thermosetting coatings.

School of Mines Research and Development Association, Rapid City, S. D.
INVESTIGATION OF AVAILABILITY OF GEOTHERMAL ENERGY FOR THE DETERMINATION OF SALINE WATER. Rept. on Contract 14-01-001-87. July 59, 50p. 9 refs. Office of Saline Water Research and Development progress rept. no. 28.
Order from OTS $1.25 PB 161 401

The Black Hills have many "hot wells," although the measured temperatures are not great. The highest well temperature measured was 168°F. at a depth of 6,250 feet. The data indicate that as a whole thermal gradients are not appreciably higher than the average thermal gradient reported for the earth's crust, except for certain local areas of two or three times the magnitude. Thus, the Black Hills do not seem to offer any unique advantage for extraction of geothermal energy. Pumping of existing hot wells offers the simplest possibility for extracting geothermal energy, but even at 168°F. and, say, 50°F. cooling water the theoretical availability would be only about 19%; the temperature level of the hot water is low, for practical purposes. Moreover, a huge heat-collecting area for the aquifer would have to be assured, something about which present knowledge does not cover. Sinking a deep shaft to reach a level of high temperature and constructing a heat-collecting area or zone would involve high capital expenditures and resulting excessive costs for the energy removed, without doubt. Moreover, there is the important

conclusion that the temperature at the heat-collecting zone is reduced significantly upon extracting a relatively small amount of heat, which inevitably reduces the availability. (Author)

South Dakota School of Mines and Tech., Rapid City.
INVENTORY OF PUBLISHED AND UNPUBLISHED DATA ON THE CHARACTERISTICS OF SALINE SURFACE AND GROUND WATERS OF SOUTH DAKOTA, by Edward H. Tullis, John P. Gries, and Joseph H. Cope. Rept. for 1 July 53-30 June 54 on Contract 14-01-001-56. June 54, 156p. 193 refs. Office of Saline Water Research and Development progress rept. no. 6.
Order from OTS $3.00 PB 161 381

Texas A. and M. Coll., College Station.
RESEARCH ON LIQUID-LIQUID EXTRACTION FOR SALINE WATER CONVERSION, by Richard Davison, Lela M. Jeffrey and others. Rept. on Contracts 14-01-001-60 (Final) and 14-01-001-77. Dec 58, 86p. 5 refs. Office of Saline Water Research and Development progress rept. no. 22.
Order from OTS $2.25 PB 161 396

A search for the most efficient solvent or solvents for use in the process was made by conducting a series of screening tests on a wide variety of solvents and obtaining detailed data such as phase equilibrium data on the most promising compounds. Particular emphasis was place on correlation of solvent properties with molecular structure. Solvent purity was given much consideration. Methods were investigated for the recovery of solvents from the brine and product water. Recovery by liquid-liquid extraction and adsorption on activated carbon and clay were studied. Preliminary data were obtained on the process operation by the use of a laboratory model. A preliminary engineering cost estimate was made for the demineralization of sea water on a large scale by the liquid-liquid extraction process.

Washington U., Seattle. Engineering Experiment Station.
RESEARCH AND DEVELOPMENT OF PROCESSES FOR DESALTING WATER BY FREEZING, by Harold M. Hendrickson and Ralph W. Moulton. Rept. on Contract 14-01-001-73. Aug 56, 173p. Office of Saline Water Research and Development progress rept. no. 10.
Order from OTS $3.00 PB 161 385

It was found that research on freezing methods for purification of sea water had not been very extensive. The second phase of the research was to run field tests with sea water on commercial and industrial icemakers of all available types, and evaluate the results obtained. Tests were made in can-ice plants, on flake-ice machines, on slush-ice machines, on tube-ice machines and on ice cream freezers. While a reduction in salinity was obtained in some cases, no commercial icemaker was found that would reduce sea water at 30,000 PPM total solids content down to potable water at 500 PPM or even down to irrigation water at 1500 PPM. The third phase of the study was to set up several representative icemakers in the laboratory to study their performance under more accurately controlled conditions, and to determine the best methods for separating the entrapped salt from the ice-brine mixture obtained by freezing. Also during this phase, theoretical studies were made of various freezing cycles in an effort to find the most efficient one, and economic studies were made of the most promising cycles.

Yale U., New Haven, Conn.
RESEARCH ON FORCED-CIRCULATION AND DROPWISE CONDENSATION TECHNIQUES FOR IMPROVING HEAT TRANSFER RATES FOR VAPOR COMPRESSION EVAPORATORS, by Harding Bliss. Rept. on Contract 14-01-001-59. Oct 55, 59p. 1 ref. Office of Saline Water Research and Development Progress rept. no. 8.
Order from OTS $1.50 PB 161 383

The experimental program was made up of two broad parts consisting of (a) measurement of over-all and film heat transfer coefficients with pure water or pure NaCl brine, (b) testing of sealing behavior over an extended period with synthetic sea water and Long Island Sound sea water. A forced circulation evaporator was built in which water and brine were heated with negligible boiling in the tubes, evaporation being accomplished by "flashing" after leaving the tubes. Two test sections were used, one of 0.951 inch inside diameter and the other of 0.761 inch inside diameter both 6 feet in length. Temperatures of steam, brine, and tube wall surface were measured.

Civil Engineering

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
FURTHER STUDIES OF CREEP BUCKLING OF CURVED BEAM UNDER LATERAL LOADING, by T. H. H. Pian and C. Y. Chow. Rept. on Contract Nonr-1841(22). Dec 58, 29p. 3 refs. Technical rept. 25-28.
Order from LC mi$2.70, ph$4.80 PB 144 860

The creep buckling analysis of curved beam given in Technical Report 25-26 (PB 139 334) has been extended to include the effect of antisymmetrical mode. It is shown that when the axial compressive stress becomes four times the Euler critical stress the antisymmetrical mode sets in to aid the snapping action and hence will yield a shorter creep buckling time. The paper also makes an analysis of the behavior of the beam succeeding the snapping action. (Author)

Bureau of Yards and Docks, Washington, D. C.
CONTRACT ADMINISTRATION. 17 Apr 57, 337p. Technical pub. NAVDOCKS TP-AD-4, Rev.; BUDOCKSINST 4330.5A.
Order from LC mi$11.10, ph$51.50 PB 144 512

This publication defines the authority and responsibili-

ties of the Bureau of Yards and Docks, its field activities, and others concerned with the administration of contracts. It also contains information on the procedures for the award, preparation, and administration of contracts. Some of the specific subjects discussed are (a) competitive bid and negotiated fixed-price construction contracts, (b) architectural-engineering (A-E) and engineering-services (E-S) contracts, (c) many miscellaneous contracts, such as demolition and equipment repair, (d) cost-plus-a-fixed-fee (CPFF) contracts, (e) utility services contracts, (f) drawings and specifications, (g) industrial security, and (h) a tabulation showing the functions reserved to the Chief, Bureau of Yards and Docks, the District Public Works Officer (DPWO), the Officer in Charge of Construction (OICC), and the Resident Officer in Charge of Construction (ROICC) in the administration of contracts after award.

Bureau of Yards and Docks, Washington, D. C.
HOUSING HANDBOOK. Engineered Performance Standards, Public Works Maintenance. July 59, 89p. NAVDOCKS p-705.
Order from LC mi$4.80, ph$13.80 PB 145 003

The housing times are presented in three categories: (1) standard maintenance, (2) room maintenance, and (3) miscellaneous work. The Task Areas are: asphalt tile - remove, reinstall; miscellaneous: carpentry, pest control, plumbing, roofing; paint, brush: acoustical tile, bathroom, bedroom, dining, living rooms, hallway, stairwell, kitchen, utility room, wall, ceiling; paint - brush or varnish: floor, woodwork; and standard maintenance: carpentry, electrical, plumbing, venetian blinds.

Bureau of Yards and Docks, Washington, D. C.
PIPEFITTING AND PLUMBING FORMULAS. Engineered Performance Standards, Public Works Maintenance. Aug 58, 387p. NAVDOCKS P-711.1.
Order from LC mi$11.10, ph$59.10 PB 145 009

The time formulas developed for the Pipefitting and Plumbing Shop are: cut and thread small pipe, measure installation for pipe length, install and remove small pipe, make and install pipe supports, clean parts and machine components, dismantle or assemble machine components, install and remove pipe insulation, adjust position or setting of machine components, inspect and check machine components, make gaskets, miscellaneous time values, install and remove bell and spigot pipe up to 10" I. D., cut and assemble copper tubing, operate toledo "donkey" machine, assemble and install threaded pipe 21/2" to 6" I. D., hydrostatic test, maintenance of fire sprinkler systems, semi-annual maintenance of fire hydrants, pipe welding - pipefitters, burn pipe, operate medium size pipe machine, gas water heater repair, supply water to ships, and cut into water main.

Bureau of Yards and Docks, Washington, D. C.
PIPEFITTING AND PLUMBING HANDBOOK. Engineered Performance Standards, Public Works Maintenance. Rev. July 59, supersedes Aug 58, 100p. NAVDOCKS P-711.
Order from LC mi$5.40, ph$15.30 PB 145 005

Section I - Spread Sheets: A spread sheet is a form for presenting typical related tasks in a sequence of varying complexities so that an estimator can compare the work content of the known task with the work to be estimated. Individual crafts are subdivided into task areas. These task areas, which may include one or more spread sheets, are arranged in alphabetical order. The task areas are further subdivided into time groups which are presented in columnar form on each spread sheet. The specific tasks within each group column are arranged from top to bottom according to increasing work content. Section II - Task Times: Task Times are derived from Operation Time values. Task Time values are those required to perform all operations constituting the task, but not the variables, such as job preparation time, travel time, or allowances for delay. They are arranged in numerical order. Section III - Operation Times: Operation Times are the tabulation of the formula values taken from the formula manual. They represent the actual time required to perform a work portion of a task. These values become the components of a task and, when added together, become the time to perform the task. These task times do not contain travel, job preparation, or delay allowances. The operation times of Section III are used in various combinations in the Task Times. Most operation times are used in more than one task area. For ease of location, they are arranged in formula numerical order.

Naval Civil Engineering Lab., Port Hueneme, Calif.
ENGINEERING STUDY OF WAVES AND CURRENTS IN THE HARBOR OF PORT HUENEME, CALIFORNIA, by J. J. Leendertse. Final rept. 7 Dec 59, 87p. 31 refs. Technical rept. 052.
Order from LC mi$4.80, ph$13.80 PB 145 157

The report presents information as to the likely effect on the water wave environment of Port Hueneme Harbor, California, and on harbor operations in general of alterations to the major wharves, of deepening the Harbor, and of proposed changes in the existing channel with entrance at the Harbor. (Author)

Electrical and Electronic Engineering

Acoustics Research Lab., Harvard U., Cambridge, Mass.
PHASE SHIFT IN ELECTROACOUSTIC TRANSDUCERS, by W. Richard Stroh. Technical memo. no. 42 on Contract Nonr-1866(24). 18 Mar 58, 32p. 17 refs.
Order from LC mi$3.00, ph$6.30 PB 138 579

A complex transfer function is defined which relates the sound pressure at a point on the principal axis of an electroacoustic transducer to the electrical input of the transducer. The argument of this function is composed of a phase function representing phase shift in the transducer, plus a shift proportional to frequency representing travel time. By using an electrical delay line to match the travel time phase shift, the shift in

the transducer itself can be measured directly. Typical phase functions for moving-coil and electrostatic loudspeakers are shown and discussed. The effect of transducer phase distortion on correlation functions is discussed, as is the use of the phase measurement in "phasing" a multiple-transducer system. (See also PB 137 455)

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
DEVELOPMENT OF ALTERNATING-CURRENT OPERATED POWER RELAYS AND CONTACTORS FOR AIRCRAFT 400-CPS ELECTRIC SYSTEMS, by R. J. Coppola. Final rept. on TED Proj. ADC EL-52048. 27 Aug 58, 48p. Rept. no. NADC-EL-5862.
Order from LC mi$3.30, ph$7.80 PB 144 937

A complete study was conducted of existing unacceptable 400-cps a-c relays and all possible design methods for a-c relay construction. Such principles as rectified current, motor-generator, induction, mechanical rectification, and shaded poles for relay operation were investigated and found to be unacceptable for the particular purpose. The study revealed the potentialities of a polyphase operated relay and the use of permanent magnets in the magnetic structure of a single phase relay. Experimental models of such relays were designed and fabricated for test purposes. The resultant "Self Seal-In A-C Relay" and the "Polarized A-C Relay" performed within reasonable limits of military specification requirements, and indicated that the design principles were sound.

Aerovox Corp., Olean, N. Y.
ADAPTATION OF CERAMIC TUBE TYPES, by John D. Cronin. Rept. on Electronic Tubes and Transistors, Contract AF 33(600)33577. June 59, 166p. 31 refs. WADC Technical rept. 59-84; AD-210 230.
Order from OTS $3.00 PB 151 922

The use of the Eimac tubes at high temperatures was investigated by simulated high temperature circuitry and by measurement of the variations in the operating point for fixed grid bias and plate voltages as a function of the ambient tube temperature. A series of mechanical mounting configurations were analyzed for use at high temperatures. The most suitable appeared to be a cylinder, a flat plate, and a cavity approach; the flat plate was the primary choice. The material chosen for construction of the configuration was an alumina ceramic. A survey of non-classified literature was made to determine the effects radiation would have upon the materials used in the 500°C. circuitry. It was determined that the tensile strengtn, yield strength, and electrical resistivity of most alloys increase with radiation, while the creep strength, fatigue strength, impact strength, density, and elongation can decrease slightly, depending upon the alloy.

Air Force Cambridge Research Center, Bedford, Mass.
INCREASING THE RELIABILITY OF DIGITAL COMMUNICATIONS SYSTEMS UNDER POOR SIGNAL CONDITIONS, by Nathan Levine, Paul J. Daly, and Harold C. Porter. June 59, 36p. AFCRC-TR-59-158; AD-228 773.
Order from LC mi$3.00, ph$6.30 PB 144 967

Synchronous communication using phase modulation: A graphical analysis showed the improvement of the phase modulation system over amplitude modulation. The amplitude modulation system is recommended where reliable S/N levels of greater than 20 db and no serious fluctuations in signal amplitude are anticipated. For the type of military service envisioned with a mobile system, however, phase modulation is superior. Amplitude modulation using an autocorrelation receiver: Two methods of instrumentation were used for evaluation. The first method compared each message on a target-for-target basis registering each erroneous target. Each non-conforming target showed up as an error. In the second method, the detected data were inserted into a standard AN/TSQ-13 digital detector after the digital receiver, a conventional receiver circuit. Tests indicated that the basic receiver circuit performance was superior to the AN/TSQ-13 digital receiver. An over-all gain of 3 to 5 db was realized over conventional methods. The high frequency method showed no worthwhile gain over the second method. The consistently greatest single cause of errors was the 600-c burst.

Airtron, Inc., Linden, N. J.
FINAL ENGINEERING REPORT, by Tore N. Anderson. Rept. on Contract AF 30(602)1178. 1 Nov 56, 42p. 28 refs. Rept. no. 6035-I; RADC-TR-57-3; AD-114 208.
Order from LC mi$3.30, ph$7.80 PB 137 649

A high powered ferrite circulator was developed for duplexing in radar systems in conjunction with conventional TR's. The final version of the duplexer showed the following low-level characteristics: a 33.8- to 35.9-kmc range, less than 0.7-db insertion loss (of which the ferrite losses were only a small part), more than 20 db of isolation between all arms, and a maximum input VSWR of 1.30. The device has inherent load-to-magnetron isolation and it removes the bulk of the power from the TR. No breakdown occurred during high-power tests at 70-kw peak power pressurized with 2 atmospheres and at 100-kw peak power with a 2:1 mismatch on 4 atmospheres.

Antenna Lab., Ohio State U. Research Foundation, Columbus.
BEAM-DIRECTION INDICATING SYSTEMS FOR TRAVELING-WAVE ANTENNAS, by Ko-Hsin Liu. Master's thesis. Rept. on Polarization Dependence of Radar Echoes, Contract AF 30(635)2811. 15 Oct 56, 35p. 4 refs. Rept. no. 612-10; RADC-TR-57-14; AD-114 241.
Order from LC mi$3.00, ph$6.30 PB 137 567

Alternative methods of measuring the direction of maximum radiation from a traveling-wave scanning antenna are presented. The direction of maximum radiation can be determined if the relative phase constant within the waveguide feed is known. Two types of non-mechanical indicating systems are considered: 1. Amplitude-measuring system, Simple

amplitude system, Compound amplitude system. 2. Phase-measuring system, Simple amplitude system with added phase shifter. Conventional phase-measuring system.

A. R. F. Products, Inc., River Forest, Ill.
USE OF TRANSISTORS IN HETERODYNE-TYPE PORTABLE FREQUENCY METER AN/URM-32( ) by Andrzej B. Przedpelski. Quarterly progress rept. (Engineering) no. 1, 15 July-15 Oct 54, on Contract DA 36-039-sc-64450. 18 Oct 54, 38p.
Order from LC mi$3.00, ph$6.30 PB 145 336

The main purpose of this Contract is to transistorize Frequency Meter AN/URM-32( ) and thus achieve a reduction in size, weight and power consumption and at the same time increase overall reliability. To accomplish this general purpose, the following work will have to be carried out. Conduct circuit studies to establish the feasibility of using transistors as active elements to reproduce or improve the electrical characteristics of Frequency Meter AN/URM-32( ). Ascertain the highest degree of accuracy and stability attainable in transistor equipment of this type. Develop data on which to base specifications for transistor characteristics which will provide reliable operation.

Armour Research Foundation, Chicago, Ill.
METHODS OF PURIFICATION OF METALS AND INTERMETALLIC COMPOUNDS, by Sherman Susman. Rept. for 15 June 58-14 May 59 on Electrical and Electronic Materials, Contract AF 33(616)5895. Nov 59, 86p. 38 refs. ARF-3133-11; WADC Technical rept. 59-303.
Order from OTS $2.25 PB 161 415

SiC, ThO_2, and ZrO_2 were studied to learn how impurities move in thermal gradients in potential materials for high temperature thermoelectric, thermionic, or photovoltaic generators. The electrical resistivity, thermal conductivity, and thermoelectric power of ThO_2 and ZrO_2 were studied at high temperatures. Thermal conductivity was measured by a method which eliminates common errors. ZrO_2 had a much lower electrical resistivity than ThO_2. ThO_2 doped with CeO_2 was minimally changed in its electrical properties. The band structure of CeO_2-stabilized ZrO_2 was more complex than that of CaO-stabilized ZrO_2. Impurity transport in polycrystalline SiC was studied by inductive coupling and spectrometric diffusibility. The total (p) of all purification effects in a thermal gradient were 32.8 and 8.4 for Ca and Al in polycrystalline SiC. Single crystal SiC was studied by spectrometric diffusibility to obtain an index, $J_t S_t / C^2 o i$, of the ease with which an impurity is transported through the solid. Values for Cu, Ca, and Al were 113, 194, and 58, respectively. (Author)

Armour Research Foundation, Chicago, Ill.
RESEARCH ON THE PYROLYTIC DEPOSITION OF THIN FILMS, by F. V. Schossberger, S. Spriggs and others. Rept. for 1 May 58-30 Apr 59 on Research on Physical Phenomena Affecting the Characteristics of Electronic Components, Contract AF 33(616)5720. Oct 59, 50p. 14 refs. WADC Technical rept. 59-363.
Order from OTS $1.25 PB 161 417

This report describes the results of a one year program devoted to the preparation, chiefly by pyrolytic deposition, of thin films potentially useful in composite molecular electronics. Of particular interest was the pyrolytic deposition of thin films with high temperature stability. Compact polycrystalline films of translucent, yellow β-SiC have been reproducibly prepared on tungsten substrates by the pyrolysis of trimethylchlorosilane vapor at 1 to 2 mm pressure and 1700°C. Unsupported films of β-SiC have been made by dissolving away the tungsten in melted sodium nitrite. Spectrochemical analyses and spectral transmission measurements verify that these films are of high purity. Nonporous films of silica on molybdenum have also been made by the low pressure pyrolysis of tetraethylsilicate; and the films of nickel metal mixed with NiO have been prepared with high temperature coefficients of electrical resistance. These films, and films of a number of ferrites such as (Ni, Zn)Fe_2O_4, have been made by spraying ethanol-ethyl acetate solutions of metal acetylacetonates on alumina substrates heated to 600° to 950°C. Dielectric films adherent to copper have been prepared by the vacuum alloying of a titanium-copper-nickel bonding layer, followed by the pyrolytic decomposition of triethanolamine titanate to titanium dioxide. The limits of composition, the conditions of firing, and the optimum thickness required for a flexible alloy layer were determined. Finally, beta-ray back-scattering has been shown to be a useful method for the measurement of film thickness. (Author)

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
A STUDY ON THE EFFECTS OF CONTINUOUS WAVE JAMMING ON THE DETECTION OF ANTI-AIRCRAFT OPERATIONS CENTER SYMBOLS, by Charles Fried, Claude D. Patton and Raymond F. Blackmer. Sep 59, 25p. 5 refs. Technical Memo. 9-59.
Order from LC mi$2.70, ph$4.80 PB 144 951

Detection time was studied for four geometric shapes, considered for adoption as Antiaircraft Operations Center Symbols, that were exposed to three degrees of simulated continuous wave jamming. The shapes studied were the Circle, Cross, Half Circle and Cross-Within-Circle. Their diameters remained constant at 5/16". The shapes were generated electronically on a Planned Position Indicator display. Detection time increased for all four symbols as the intensity of continuous wave jamming increased, but this increase was not significant for the increase from the no noise to the mild noise level. All symbols, except for the Cross, had approximately the same detection time for each of the three noise levels. Any differences were not significant. The number of errors made by the subject were small and did not show any trend. The significantly lower detection time for the Cross at all noise levels is discussed. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PROCEEDINGS OF THE ANNUAL BATTERY RESEARCH AND DEVELOPMENT CONFERENCE [NO. 12] 21-22 MAY 1958. [1958] 141p. 35 refs.
Order from LC mi$7.20, ph$22.80 PB 145 520

Symposia included were on fuel cells; nickel-cadmium batteries; special purpose batteries; special purpose batteries; battery symposium; on power sources of the future. (See also PB 137 392)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PROCEEDINGS OF THE ANNUAL POWER SOURCES CONFERENCE [NO. 13] 28-30 APRIL 1959. [1959] 183p. 148 refs.
Order from LC mi$8.40, ph$28.70 PB 145 521

Sessions included were on space power; thermal energy conversion; nuclear energy sources; solar energy sources; secondary batteries; comparison of energy conversion systems; fuel cell batteries; primary batteries; high rate batteries.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
TRANSISTORIZED EQUIPMENT FOR MEASURING TRANSISTOR FREQUENCY RESPONSE, by Bernard Reich and William Orloff. 2 Mar 59, 17p. USASRDL Technical rept. 2016; AD-214 650.
Order from LC mi$2.40, ph$3.30 PB 145 138

The theory and operation of a transistorized equipment capable of measuring the frequency response of transistors is described. The characteristic chosen for representing this parameter is the f_t frequency or the frequency at which the current gain «s unity. The equipment employs a transistor oscillator and small-signal r-f amplifier as the basic elements of the system. Although the equipment is capable of representing frequency responses in excess of 1000 mc/sec, the actual frequency used by the set does not have to exceed 100 mc/sec. (Author)

Bartol Research Foundation, Franklin, Inst., Swarthmore, Pa.
RESEARCH INVESTIGATION OF CATHODE EMISSIVE MATERIALS, by W. E. Danforth, D. L. Goldwater and others. Scientific rept. no. 2 on Contract AF 19(604)3904. 15 Oct 58, 31p. 25 refs. AFCRC-TN-58-550; AD-160 859.
Order from LC mi$3.00, ph$6.30 PB 138 434

Fabrication and testing of thorium impregnated matrix cathodes. A study of the formation of ions by collision between electrons and thorium atoms in the cathode-anode space investigation of desorption of thorium from a tungsten surface by electron bombardment. (See also PB 137 001)

Battelle Memorial Inst., Columbus, Ohio.
COMPONENT EVALUATION AND SPECIFICATION ENGINEERING ON TASK XV. RESISTORS, VARIABLE, SUBMINATURE, by L. H. Stember, Jr. and P. G. Perry. Final rept. on Contract DA 36-039-sc-63136. 12 Aug 55, 115p. AD-115 178.
Order from LC mi$6.00, ph$18.30 PB 137 810

This is the final report on a program of investigation of subminiature, variable resistors. These resistors are one of a number of components studied in an evaluation program conducted under Contract No. DA 36-039-sc-63136. The general objective of this work is to determine the component's ability to meet the performance characteristics required by guided missiles, missile guidance systems of the Army Ordnance, and the highly specialized electronic equipments of the Signal Corps. The information obtained will be utilized to guide the component application engineer in the use of components, the component development engineer in furthering component improvement, and the specification specialist in defining a minimum quality level from production that will be acceptable for military service. Eight hundred and sixty one variable resistors were procured from six designated manufacturers to provide the specimens required to conduct the investigations scheduled in the program. These were separated into six groups and the investigations conducted on these were as follows: Group I. Initial resistance and linearity measurements; II. Rotational life; III. Load life; IV. Vibration (10-55 cps); Moisture resistance cycling (temperature cycling with high relative humidity). V. Minimum resistance measurements; Low-temperature storage; Low-temperature operation; Temperature cycling; VI. Temperature coefficient measurements; Short-timed overload; Insulation-breakdown voltage; Strength of mechanical rotation stops. (See also PB 137 866)

Bell Telephone Labs., [Whippany, N. J.]
MICROWAVE SOLID-STATE DEVICES. Interim rept. no. 7, 1 July-30 Sep 58, on Contract DA 36-039-sc-73224. 15 Nov 58, 34p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 144 943

Results of the Solid-State Maser studies are reported. Work on the spectra of Cr doped Al_2O_3 (ruby), Cr doped $3BeO \cdot Al_2O_3 \cdot 6SiO_2$ (emerald) and Co doped Al_2O_3 has been completed. A 6 kmc unilateral travelling wave maser (TWM) using a ruby loaded comb type digital structure has been built and tested. A gain of 23 db with a 25 mc bandwidth was obtained over an electronically tunable frequency range of 350 mc. By employing stagger tuning a gain of 13 db with a bandwidth of 67 mc was obtained in the same structure. Preliminary results obtained for diffused germanium nonlinear-capacitance diodes are reported. The best cut-off frequencies obtained (~80 to 100 kmc) are comparable to results obtained for silicon, but the best noise figure obtained in a 6 kmc amplifier (4.5 db) is inferior to that obtained for silicon varactor diodes (2.5 db). The inferior noise figure of the germanium diode appears to be due to shot noise, inasmuch as the silicon and germanium diodes had comparable figures of merit. A theoretical treatment of broadband harmonic generation effected by non-linear capacitance is described. The treatment is similar to that reported earlier, except that an attempt is made to evaluate the effects of parasitics by including a fixed parallel capacitance and a series resistance. Results show that the

parasitics do not produce appreciable degradation of performance provided the frequency of the desired harmonic is sufficiently lower than a cut-off frequency defined in terms of the parasitic resistance and capacitance. (Author)

Bell Telephone Labs., [Whippany, N. J.]
MICROWAVE SOLID-STATE DEVICES. Interim rept. no. 8, 1 Oct-31 Dec 58, on Contract DA 36-039-sc-73224. 15 Feb 59, 32p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 144 934

Noise temperature measurements have been made on a traveling wave maser preamplifier. The measured noise temperature referred to the input terminals at room temperature is $10.7 \pm 2.3^{\circ}K$. This compares favorably with a calculated noise temperature of $11.4 \pm 1.2^{\circ}K$. Feasibility tests have been made on a ruby maser for a signal frequency of 1500 mc. The measured spin temperature of $-0.28^{\circ}K$ indicates that compact traveling wave masers may be built at this frequency. A theoretical analysis of the gain and noise figure of a lower sideband nonlinear capacitance diode amplifier is presented. Approximate values of noise figure are calculated and compared with several measured noise figures. The comparison indicates that the diodes were operated at close to optimum conditions. The generation of subharmonics by a nonlinear capacitance diode is discussed briefly, from a theoretical point of view, and an experiment is described, in which the one-half harmonic was generated. (Author) (See also PB 144 943)

Berkeley Div., Beckman Instruments, Inc., Richmond, Calif.
APPLICATION OF TRANSISTORS TO FREQUENCY METER FR-67( )/U AND MANUFACTURE OF EXPERIMENTAL MODELS, by Hamilton Chisholm, Robert Ellsworth, and Robert Evans. Final rept. on Contract DA 36-039-sc-63238. 10 Feb 56, 60p.
Order from LC mi$3.60, ph$9.30 PB 145 260

Two complete frequency meters were manufactured and tested for conformance with all electrical specifications. The major portion of the final report dwells upon the circuitry of the final units. The theory and characteristics of each major function is given in detail. Following this is a section on operating techniques which should serve as a complete guide in the use of the instrument. Maintenance procedures are then given with emphasis on precautions peculiar to the instrument. The text of the report makes frequent reference to photographs, sketches, and complete schematics. (Author)

Chatham Electronics, Livingston, N. J.
INDUSTRIAL PREPAREDNESS MEASURE FOR POLYOPTIC SEALING OF HYDROGEN THYRATRON TUBES. Quarterly progress rept. no. 1, 1 July-30 Sep 59, on Contract DA 36-039-sc-81289. 30 Nov 59, 10p.
Order from LC mi$1.80, ph$1.80 PB 145 220

The first quarter of the contract was spent in ordering necessary materials and equipment such as glass, lap material, grinding and lapping compounds, a life test unit, and an automatic exhaust machine. Different polishing procedures and techniques were investigated, and old methods revised and improved to make the process more suitable for production. (Author)

Clevite Research Center, Cleveland, Ohio.
INITIAL STUDY AND DEVELOPMENT OF PIEZOELECTRIC CERAMIC I-F TRANSFORMERS, by O. E. Mattiat and W. F. Ford. Final rept. for 15 May 55-14 June 56 on Contract DA 36-039-sc-64644. 15 July 56, 84p. AD-115 854.
Order from LC mi$4.80, ph$13.80 PB 145 205

The two basic approaches of using piezoelectric ceramic resonators for band-pass filter purposes are described. The first is to employ such resonators as electric network elements in otherwise conventionally designed filters. The simplest two structures, as reported in detail in the First Quarterly Progress Report, are reviewed and impedance and insertion loss curves are presented. The second approach, employing ceramic resonators in new unconventional ways is summarized and impedance and attenuation behavior of one-, two- and three-disk filters are described. Some technical details (polarization and electroding) and material problems including aging, temperature-coefficient, dielectric constant, and quality factor are discussed. Conclusions are drawn for the application of one- and three-disk filters and recommendations are made for future development work. Representative sample filters are described in detail. (Author)

Colorado U. Engineering Experiment Station, Boulder.
STATIC TRANSVERSE POTENTIAL SOLUTIONS FOR DENSE DRIFTING ELECTRON BEAMS, by J. E. Lauer and J. C. Twombly. Technical rept. no. 1 on Contract Nonr-1147(06). 1 Mar 59, 53p. 7 refs.
Order from LC mi$3.60, ph$9.30 PB 144 896

The concept of supercritical perveance is reviewed, and nomenclature is established for the distinct regions of perveance separated by abrupt changes in potential state. Static transverse-potential functions are obtained for long drifting beams operating in the high- and low-potential modes. Change from one of these potential modes to the other is effected by excursions of beam perveance past certain critical values. These are calculated for each beam configuration.

Columbia U. School of Engineering, New York.
GENERAL FLOW GRAPH TECHNIQUE FOR THE SOLUTION OF MULTI-LOOP SAMPLED SYSTEMS, by R. Ash, W. H. Kim, and G. M. Kranc. Technical rept. T-37/B on Contract AF 18(600)677. 31 July 59, 33p. 10 refs. CU-57-59-AF-677-EE; AFOSR-TN-59-824.
Order from LC mi$3.00, ph$6.30 PB 144 752

This paper presents a flow-graph approach for analyzing multi-loop sampled-data systems. Two techniques for finding the sampled output are examined. These are: first, construction of a "sampled" signal flow-graph from the original system; second, a general

gain formula which can be directly applied to the original system. The theorems necessary to establish the formula are rigorously proven. The first technique allows two possible modes of solution. The sampled output can be found directly from the "sampled" flow graph by the use of Mason's Formula, or in case of a more complicated multi-loop system, the problem of enumerating non-touching feed-back loops can be simplified by the use of topological matrices. Techniques developed in the paper are also applied to the solution of multirate systems. (Author)

Columbia U. School of Engineering, New York.
OPTIMUM MULTIRATE CONTROLLER FOR A SAMPLED FEEDBACK SYSTEM, by G. M. Kranc. Technical rept. T-38/B on Contract AF 18(600)677. 1 Oct 59, 31p. 8 refs. CU 59-59-AF-677-EE; AFOSR-TN-59-1095.
Order from LC mi$3.00, ph$6.30 PB 145 100

This paper extends optimum design procedures to sampled-data systems with a multirate controller used as a discrete compensator. The multirate controller used as a discrete compensator. The multirate controller is a discrete network which in response to input samples at time $t = 0, T, 2T, \ldots$ produces output samples at time $t = 0, T/n, 2T/n, \ldots$ (where n is an integer), any output sample being a linear combination of the past and present inputs and outputs. It is shown in this paper how to design this controller to achieve a least mean square continuous error with random inputs or a least integral continuous error with known test input functions. The advantages of the multirate controller over the single-rate compensator are demonstrated. (Author)

Convair, Fort Worth, Tex.
FAST-RESPONSE LINEAR MICRO-MICROAMMETER, by J. R. Gardner. Rept. on Contract AF 33(600)32054. 20 Aug 58, 19p. MR-N-181; NARF-58-36T.
Order from LC mi$2.40, ph$3.30 PB 145 346

A prototype fast-response linear micromicroammeter has been developed which uses the 100 percent-feedback type of circuit without the usual dc-to-ac input converter. The circuit consists basically of an ORNL electrometer and a new type of push-pull magnetic amplifier. The output impedance of the electrometer matches the input impedance of the magnetic amplifier. The magamp output is fed back to the electrometer input to obtain fast response time (<0.1 sec) and negligible drift. The accuracy of measurement depends on the values of input and feedback resistors, and voltage gain is eliminated as a measure of accuracy and linearity. The ranges of current measurement extend from 10^{-11} amperes full scale to 5×10^{-6} amperes full scale, in 18 steps. (Author)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
ELECTRON TUBE RESEARCH FOR RELIABILITY: HIGH FREQUENCY AMPLIFIER STUDIES, by G. C. Dalman and N. DeClaris. Final rept., Part III, 15 May 55-31 Oct 58, on Contract DA 36-039-sc-64646. [1958] 518p. 1221 refs. Research rept. EE-412; AD-217 093.
Order from LC mi$11.10, ph$78.90 PB 145 473

Included are the following reports:
Wideband amplifier studies, Technical rept. no. 46, EE-413
Triode distributed amplifiers, Technical rept. no. 36, EE-400, AD-219 801
Input admittance of tubes for distributed amplifiers, Technical rept. no. 41, EE-405, AD-219 805
Wideband amplifiers and related topics: a selected bibliography, Technical rept. no. 38, EE-402, AD-219 802L
How to obtain properties of the solutions of differential equations without actually solving them, Technical rept. no. 39, EE-403, AD-219 803
(See also PB 145 472)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
ELECTRON TUBE RESEARCH FOR RELIABILITY: PHYSICAL ELECTRONICS STUDIES, by G. C. Dalman and N. DeClaris. Final rept., Part II, 15 May 55-31 Oct 58, on Contract DA 36-039-sc-64646. [1958] 362p. 91 refs. Research rept. EE-411; AD-217 092.
Order from LC mi$11.10, ph$56.10 PB 145 472

A summary of studies of important tube parameters affecting reliability including measurement of (1) cathode parameters such as cathode emission, cathode resistance, cathode temperature; (2) measurement of correction potential, and (3) residual gas in vacuum tubes. Included are the following reports:
The estimation of total cathode emission from shot noise measurements, Technical rept. no. 42, EE-406, AD-219 806
A theoretical basis for the determination of the total emission of oxide cathodes with the shot-noise method, Technical rept. no. 40, EE-404, AD-219 804
Preliminary studies on the limitations of radio frequency mass spectrometer, Technical rept. no. 45, EE-409, AD-219 809
The measurement of residual gas in vacuum tubes, Technical rept. no. 31, EE-330, AD-135 822(a)
The measurement of cathode resistance using retarding and accelerating fields, Technical rept. no. 37, EE-401, AD-206 833L
A dynamic conductance and transconductance measuring equipment for electron tubes, Technical rept. no. 35, EE-352, AD-159 136
Measurement of correction potential ε in electron tubes, Technical rept. no. 28, EE-285
Study of a cathode temperature measuring device, Technical rept. no. 27, EE-272
(See also PB 145 471)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
ELECTRON TUBE RESEARCH FOR RELIABILITY: STATISTICAL STUDIES, by G. C. Dalman and N. DeClaris. Final rept., Part I, 15 May 55-31 Oct 58, on Contract DA 36-039-sc-64646. [1958] 353p. 32 refs. Research rept. EE-410.
Order from LC mi$11.10, ph$54.60 PB 145 471

A summary of statistical studies dealing with the analysis of field failure of tubes, specifying tube reliability quantitatively, and special statistical problems that arose during the course of investigations. Included are the following reports:
Determination of vacuum tube catastrophic and wear-out failure properties from life-testing data, Technical rept. no. 44, EE-408, AD-219 808
Computer methods for estimating Weibull parameters in reliability studies, Technical rept. no. 34, EE-344
The Weibull distribution in reliability studies, Technical rept. no. 33, EE-343
Quantifying the life quality of electron tubes with the Weibull distribution, Technical rept. no. 26, EE-271
Summary of the tube analysis program, Technical rept. no. 43, EE-407, AD-219 807
A study of factors influencing electron tube failures, Technical rept. no. 32, EE-331
On tube replacement policy, Technical rept. no. 30, EE-315
A generalization in the calculation of equipment reliability, Technical rept. no. 29, EE-314
Statistical analysis of tube failures by cause of defect, Technical rept. no. 25, EE-259

Diamond Ordnance Fuze Labs., Washington, D. C.
ELECTRICAL CHARACTERISTICS OF COILED WAVEGUIDE, by H. S. Jones and H. K. Morlock. 3 Nov 58, 18p. 2 refs. Technical rept. TR-637; AD-209 130.
Order from LC mi$2.40, ph$3.30 PB 144 857

A comparison is made between the performance of a coiled waveguide section and a straight section of equivalent length. Stages of development and properties of coiled waveguides are discussed, and test results of several coils and assembled units are given. Theoretical calculations and an empirical determination of waveguide time delay are given. Some characteristics of coaxial delay lines are also discussed. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
FLAT VIBRATION-GENERATOR FOR MICROPHONIC INVESTIGATIONS, by J. D. Rosenberg. 30 Aug 54, 44p. 10 refs. Technical rept. TR-102.
Order from LC mi$3.30, ph$7.80 PB 145 617

A vibration-generator which was developed for the investigation of subminiature tube microphonics is described. Its characteristic frequency-acceleration curve, when properly adjusted, is flat within ±20% at 10 g from 100 to 10,000 cps. The fabrication blueprints of the generator and of a convenient quick-change tube clamp and tube-lead clamp are included. In addition, microphonic test techniques - white noise production test, swept frequency test, and white noise resonance test - which are dependent upon the generator, are presented, as well as a few sample recordings, and a general discussion of the tests. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
OSCILLATOR PERFORMANCE OF TRANSISTORS IN THE HF TO UHF RANGE, by Wolfgang M. Feist. 16 Oct 59, 51p. 6 refs. Technical rept. TR-724.
Order from LC mi$3.60, ph$9.30 PB 145 270

An outline is given of the factors to be considered in the design and construction of high-frequency transistor oscillators having optimal output efficiency. The design and construction of test oscillators covering the range from about 10 to over 1000 Mc is described. Results of oscillator performance of transistor types M2039, 2N500, 2N502 and 2N700 are given. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
A SAMPLING PULSE OSCILLOSCOPE UNIT TRANSISTORIZED, 'SPOUT', by Philip Emile, Jr. and George R. Yetter. 6 Nov 59, 44p. 4 refs. TR-761.
Order from LC mi$3.30, ph$7.80 PB 144 706

A Sampling Pulse Oscilloscope Unit Transistorized, "SPOUT", capable of resolving repetitive pulses with risetimes in the order of 1 mμs was designed and built. SPOUT was built as a plug-in unit for a standard oscilloscope. A narrow pulse (approximately 1 mμs wide) is generated by an avalanche transistor switch and used to sample repetitive, unamplified input pulses. From the samples, a composite picture of the input pulse is formed on a cathode-ray tube (CRT). The main advantage of SPOUT and sampling oscilloscopes in general, is the possibility of viewing narrow (mμs) pulses with a low frequency CRT by trading sampling time for bandwidth. The disadvantages of the sampling method are that the pulse must be repetitive, the maximum and minimum input pulse rates are limited, and only a small dynamic range of input pulses can be observed. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
UTILIZING AN ELECTRONIC COMPUTER TO OPTIMIZE A TRANSISTOR NOR CIRCUIT, by E. L. Cox and L. L. Hall. 20 Oct 59, 21p. 2 refs. TR-748.
Order from LC mi$2.70, ph$4.80 PB 144 707

The accuracy with which a transistor NOR circuit can be designed for minimum power dissipation has been increased by including an additional parameter not considered in a previous analysis. The method of design involves determining the values of the input resistors, R_1, the maximum collector current, I_C, the collector resistor, R_C, and the collector supply voltage, V_{CC}, from the basic NOR circuit parameters (β/S, I_{CBO}, M, N, V_{BE}). The determination of R_1 consists of obtaining two analytical expressions, one larger and one smaller than the optimum R_1. The optimum R_1 is then obtained by numerical interpolation on an electronic computer and is subsequently used to compute the other quantities. The flow diagram of the computer program is included, as are graphical results indicating the trends of minimum power dissipation with changes in the basic NOR circuit parameters. (Author)

Eastman Kodak Co., Rochester, N. Y.
DEVELOPMENT OF AMMONIA VAPOR ACTIVATED BATTERIES, by V. M. Bryant, Jr., B. K. Burke, and J. B. Schliff. Quarterly rept. no. 7, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-71232. [1959]. 35p.
Order from LC mi$3.00, ph$6.30 PB 144 915

Task A (High Rate Battery). Report of work progress accomplished on the following phases: (2) testing and experiments: battery stack-properties of impregnated electrolyte pads, (5) redesign and evaluation: stack components; activator. Task B (Low Rate Battery). Report of work progress on the following phases: (2) testing and experiments: package-A-Section, B_1 Section, B_2 Section, C Section, (3) preliminary design and construction: stack, activator. (Author) (See also PB 139 061)

Electrical Engineering Research Lab., U. of Texas, Austin.
ANTENNA PATTERN FLUCTUATIONS AT 4.3 MILLIMETER WAVELENGTHS DUE TO ATMOSPHERIC INHOMOGENEITIES, by C. W. Tolbert, C. O. Britt, and A. W. Straiton. Rept. on Contract Nonr-375(01). 13 Dec 57, 15p. 6 refs. Rept. no. 96; AD-151 653.
Order from LC mi$2.40, ph$3.30 PB 138 074

A comparison was made between the fluctuation of optical images and the fluctuation of signal strength at millimeter wavelengths owing to inhomogeneities of the atmosphere. Measurements were made at 4.3-mm wavelengths to determine some of the characteristics and orders of magnitude of dancing, pulsation, and scintillation that might affect seeing at these wavelengths. Simultaneous measurements were made with 2 receivers of the signal strength over a 7.5-mi propagation path. The separation between the 2 receivers was varied from 1 to 50 ft. Results showed a limitation on the resolving power of narrow beam antennas owing to the inhomogeneities of the lower atmosphere. The seeing ability of easily obtainable antennas operating at millimeter radio wavelengths is limited by the atmosphere similar to the manner in which the seeing ability at optical wavelengths is limited.

Electrical Engineering Research Lab., U. of Texas, Austin.
PHANTOM RADAR TARGETS AT MILLIMETER RADIO WAVELENGTHS, by C. W. Tolbert, A. W. Straiton, and C. O. Britt. Rept. on Contracts Nonr-375(01) and Nonr-375(07). 21 Feb 58, 20p. 5 refs. Rept. no. 99; AD-156 772.
Order from LC mi$2.40, ph$3.30 PB 138 133

This report describes the techniques and the measured radar returns from "phantom targets" using 8.6 & 4.3 millimeter radars. The radar returns are compared to the measured back-scattering cross sections of water drops, insects, steam and other materials at 8.6 millimeter wavelength as measured by a c. w. radar at this wavelength. Within the limits of the conditions used in the laboratory, it was impossible to produce returns from synthesized refractive index gradients of sufficient magnitude to account for those noted on the radar. It is, therefore, concluded that for the millimeter wavelengths and the short ranges considered, the observed phantom returns were due to solid or liquid particles in the atmosphere.

Electron Tube Research Lab., U. of Minnesota, Minneapolis.
STUDIES ON BASE NICKELS FOR OXIDE COATED CATHODES, by W. G. Shepherd. Scientific rept. no. 3, 15 Oct 58-15 Jan 59, on Contract AF 19(604)3890. [1959]. 72p. AFCRC-TN-59-377; AD-217 857.
Order from LC mi$4.50, ph$12.30 PB 144 955

Coating adherence studies: The procedure for the coprecipitation of $(BaSr)CO_3$ from $Ba(NO_3)_2$ and $Sr(NO_3)_2$ is detailed; any deviation from the specified temperature, pH, or concentrations of reactants will affect the density and particle size of the carbonates. The density of the radioactive carbonates was nearly doubled when radioactive $Sr(NO_3)_2$ was used. To obtain the desired density it was necessary to redissolve the high density carbonates in a low normality HNO_3 solution and reprecipitate. Studies of controlled chemical activation: A series of experiments concerning the interactions between active-based and passive-based cathodes are described. The experiments consist in exposing a passive-based cathode to a controlled pressure of free Ba or to the evolution of an active metal (Mg) from a heated anode. An experimental study of the nature of chemical activation: A system was designed to permit the controlled variation in the rate at which a reducing additive is dispensed to the oxide coating from the cathode base. Alloy based cathodes: The emission characteristics were determined for oxide coatings on an 0.22% Al-Ni alloy base operating at 1119°K for 442 hr. Titanium anode studies: Extended operation of a passive-based oxide cathode exposed to a heated Ti anode resulted in a slow decay in peak emission. (See also PB 140 679)

Electronic Communications, Inc., Timonium, Md.
A PRECISION PHASING ELEMENT. Interim engineering rept. for 1 July-30 Sep 58 on Contract AF 30(602)1776. [1958] 51p. 1 ref. RADC-TR-58-148; AD-205 915.
Order from LC mi$3.60, ph$9.30 PB 138 128

A system for obtaining precision electronically controllable phase shift in the C-band region is presented. The system utilizes a folded-waveguide ferrite phase shifter element whose phase shift is controlled by a servo system referenced to a variable frequency microwave signal. With this system 360° phase change can be accomplished in 2.5 milliseconds. Bench tests indicate that temperature changes, magnetic field interaction effects, and hysteresis effects are held to negligible proportions within the operating limits of the phase shifter. The phase shifter element will handle peak power levels up to 50 kw without appreciable increase in loss. Auxiliary investigation on ferrite materials made during the course of this contract are discussed and typical results are given. Limits on the capabilities of phase shifters and switching circuits are given along with recommendations for future work. (Author)

Electronics Research Lab., U. of California, Berkeley.
THE ANALYSIS OF SAMPLED-DATA CONTROL SYSTEMS WITH PERIODICALLY TIME VARYING SAMPLING RATE, by F. J. Mullin and E. I. Jury. Rept. on Contract AF 18(600)1521. 30 June 58, 25p. 12 refs. Series no. 60, issue no. 207; AFOSR-TN-58-665; AD-162 196.
Order from LC mi$2.70, ph$4.80 PB 138 060

The z-transform is used to solve sampled-data feedback systems which have a periodically time varying sampling rate. Such systems are described by linear difference equations with periodic coefficients; however the difference equation which describes the system at the sampling instants corresponding to KN, where N is the period of the coefficients and K = 0, 1, 2, ... is a linear difference equation with constant coefficients. Thus, by forming a series of constant coefficient difference equations which individually describe the system at sampling instants corresponding to n = KN, KN+1, KN + 2,... (K+1) N-1, the time varying features of the system are in essence removed from the analysis. The z-transform can then be used to solve the resulting constant coefficient difference equations. The response between sampling instants can also be obtained from the solution of the difference equations.

Electronics Research Lab., Stanford U., Calif.
COMMUNICATION TECHNIQUES (MODULATION) PROJECT, by Oswald G. Villard, Jr. Final rept. for 1 June 51-31 Aug 53 on Contract W28-099-ac-131. 31 Aug 53, declassified 4 Nov 53. 59p. 8 refs. AD-22 024.
Order from LC mi$3.60, ph$9.30 PB 145 335

Electronics Research Lab., U. of California, Berkeley.
ANALYSIS OF INTEGRAL-SQUARE ERROR IN SAMPLED-DATA CONTROL SYSTEMS, by Behram Homi Bharucha. Rept. on Contract AF 18(600)1521 30 June 58, 52p. 11 refs. IER Series no. 60, issue no. 206; AFOSR-TN-58-679; AD-162 211.
Order from LC mi$3.60, ph$9.30 PB 137 786

Finite moments of the squared error of a linear time-invariant (continuous or sampled-data) control system for a non-random input are developed as integrals in the modified z-transform domain. An explicit solution of the zero moment of the total squared error integral is given as the ratio of determinants of two nxn matrices where n is the order of the system characteristic polynomial in z and the elements of the matrices are obtained readily from the coefficients of the rational form in z of the modified z-transform of the error signal.

Electronics Research Lab., U. of California, Berkeley.
A GASEOUS-CONDITION LINEAR AMPLIFIER WITH MAGNETIC FOCUSING, by John Noland Dukes. Master's thesis. Scientific rept. no. 5 on Contract AF 19(604)2270. 30 June 59, 58p. 9 refs. IER series no. 60, issue no. 240; AFCRC-TN-59-589.
Order from LC mi$3.60, ph$9.30 PB 144 593

An investigation is described to determine the feasibility of linear amplification by means of a cold-cathode tube with the electrode configuration and the gaseous-conduction properties of the Philips Ion Gauge but, unlike the latter, with electrically independent cathodes. The characteristics of this tube indicate that linear amplification can be attained with the tube operating either as a current-gain amplifier or as a "regenerative direct-coupled" amplifier in a manner similar to a negative-resistance amplifier. The negative-resistance property of the device is also utilized for oscillator operation, and a graphical analysis of the results is made. A theory is developed, based in part on the results of particle-extraction experiments in which a modified version of the tube was used, to explain the voltage-current characteristics of the device, including the negative-resistance effects. The negative resistance observed was of the short-circuit-stable variety, which is unusual in a gaseous-conduction device. (Author)

Electronics Research Lab., U. of California, Berkeley.
LOSS EQUALIZER SYNTHESIS UTILIZING THE IBM 701, by R. H. Mitchell. Rept. on Contract N7onr-29529. 12 Jan 59, 47p. 6 refs. IER series no. 60, issue no. 224.
Order from LC mi$3.30, ph$7.80 PB 144 520

The equalization problem has long confronted the engineer with the design of networks to produce a given loss over a specified frequency band. This given loss of the equalization network, coupled with that of the transmission line, some other networks, etc., will (it is hoped) produce a flat loss over this same frequency band. In the past, the choice of networks to produce this desired loss has been rather haphazard--depending on cut-and-try and, most generally, on the experience of the design engineer. This paper was written in order to give a straight-forward design procedure for developing a network of constant-R circuits in cascade which will produce any desired loss in the frequency band. The IBM 701 computer at the University of California Computer Center was used in the analysis of four curves to check the validity of the process. In Appendix D will be found the results of analysis; and it can be seen that, by expanding the program as presented here, practically any loss function may be approximated to a very good degree by this method.

Electronics Research Lab., U. of California, Berkeley.
OPTIMUM SYNTHESIS OF R. C. LADDER NETWORKS, by E. S. Kuh and A. Paige. Rept. on Contract N7onr-295(29). 12 Jan 59, 38p. 3 refs. IER Series no. 60, issue no. 223; Rept. no. 78.
Order from LC mi$3.00, ph$6.30 PB 144 862

Electronics Research Lab., U. of California, Berkeley.
QUARTERLY PROGRESS REPORT. Rept. for 1 Oct-31 Dec 58 on Contracts N7onr-29529, Nonr-222(53, 54, 57). 15 Jan 59, 19p. 4 refs. Series no. 60, Issue no. 23.
Order from LC mi$2.40, ph$3.30 PB 145 072

Contents:
Backscattering cross-sections of perfectly conducting objects of revolution
Stripline between curved boundaries
Frequency independent antennas
Network theory
Electronic circuit research
Ferrite field-displacement device for slot coupling control
(See also PB 143 555)

Frankford Arsenal, Philadelphia, Pa.
A PROPOSAL FOR EVALUATING AND IMPROVING ACCELEROMETERS, by Vernon Ames, Meyer Shulman, and Saul Wanetick. 15 Oct 58, 13p. Technical note TN-1108, AD-204 454.
Order from LC mi$2.40, ph$3.30 PB 145 616

A program for improving conventional piezoelectric accelerometers is proposed. New concepts in accelerometer design are proposed using other than the piezolectric principle as a solution to eliminate secondary effects which affect sensitivity and linearity characteristics. (Author)

General Electric Co., Schenectady, N. Y.
INVESTIGATION OF VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS, by N. J. Hawkins and J. H. Affleck. Scientific rept. no. 1 on Contract AF 19(604)4093. 29 Aug 58, 24p. 6 refs. AFCRC-TN-58-372; AD-160 820.
Order from LC mi$2.70, ph$4.80 PB 137 710

The object of this investigation is to study experimentally the emission and evaporation rate of cathodes composed of refractory salts with low work function activator elements. Also, an attempt will be made to evolve a correlation theory which will aid in design of practical cathodes and give an insight into the emission properties of untried combinations of related materials. Initially, the general problem of a relation between emission of electrons and evaporation rate activator elements is examined by methods of thermodynamics. This leads to the effective dipole moment present at a surface and is expressed in an equation of state for the film. Next, considering the evaporation of adsorbed particles using Langmuir's approach a general equation of state is obtained for a sorbed film. Then in the case of an ionic film of one metal on another a relation is derived between the relative evaporation rate of electrons at zero field and the adatom evaporation in terms of the numbers of monolayers, the number of atoms per unit area to produce a complete monolayer, the temperature of the system and the condensation coefficient. The assumptions used in deriving the general relation between emission and life are discussed. Some of these assumptions may have to be modified in the systems that are to be studied. (Author)

General Electric Co., Schenectady, N. Y.
STUDY OF NUMERICAL INTEGRATION METHODS FOR ANTENNA PATTERN CALCULATIONS, by C. C. Allen. Scientific rept. no. 1 on Antenna Beam Scanning, Contract AF 19(604)1848. 15 Aug 58, 61p. 5 refs. AFCRC-TN-58-389; AD-160 855.
Order from LC mi$3.90, ph$10.80 PB 137 794

A study of numerical integration methods suitable for antenna pattern calculations was conducted for the purpose of determining their accuracy and relative costs. The general principles of numerical integration are discussed and four methods outlined in detail. The results of applying these methods to a simple cosine distribution are presented and analyzed. The relation of these results to those for a pattern integral having a nonlinear phase function is discussed. The Gaussian quadratures are shown to have the highest degree of precision and lowest cost in general, while Filon's method is preferable when integrals having a linear phase function are calculated over a large range of pattern angle. The procedure for applying these methods to double numerical integration is outlined. (Author)

Georgetown Coll. Observatory [Washington, D. C.]
A STABLE DIRECT-CURRENT AMPLIFIER FOR A PHOTOELECTRIC PHOTOMETER, by Charles F. Dohne and Francis J. Heyden. Technical rept. no. 11 on Contract AF 19(604)880. Feb 58, 5p. GCO monograph no. 8; AFCRC-TN-58-226; AD-146 882.
Order from LC mi$1.80, ph$1.80 PB 138 135

A direct current amplifier has been designed for use with a Multiplier Phototube. Stability and simplicity are obtained by using balanced circuitry, silicon power rectifiers and transistors. Light filters and voltage control of the Multiplier Phototube are employed. The purpose for which this amplifier was developed is to provide a stable and relatively simple direct current amplifier for photoelectric observation and recording of the total solar eclipse in the field.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF METHODS FOR MEASURING THE EQUIVALENT ELECTRICAL PARAMETERS OF QUARTZ CRYSTALS, by Douglas W. Robertson, S. N. Witt, Jr. and William R. Free. Progress rept. no. 2, 16 July-15 Oct 56, on Contract DA 36-039-sc-71191. [1956] 37p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 138 497

Work has continued on the development of a more sensitive detector system for use with standard impedance bridges. Two experimental crystal oscillators, the Plate Degenerative Oscillator and a capacitance bridge oscillator, appear suitable for use as driving sources for the coaxial crystal parameter bridge being developed. Experimental models of each have been successfully operated with various crystals at frequencies up to and above 300 mc/sec. A calorimetric system utilizing a thermistor bridge makes possible the measurement of crystal power dissipation without any electrical connection to the crystal parameter bridge. (See also PB 138 498)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Vernon Crawford and Donald W. Fraser. Progress rept. no. 1, 1 Feb-1 May 53, on Contract DA 36-039-sc-42590. [1953]

45p. 7 refs.
Order from LC mi$3.30, ph$7.80 PB 138 184

A conference with representatives of the Signal Corps early this quarter resulted in a decision to concentrate upon two phases of experimental work during the year. These two phases are respectively: (1) continuation of research on coaxial cavities as mediums for oscillator control, utilizing the information gained under a previous project, and (2) initiation of studies of the absorption and transfer characteristics of piezoelectric quartz crystals when excited at very high orders of mechanical overtones. Three new cavities have been designed during the period of this report. The one to which the most attention has been devoted is constructed, in the main, of Stupalith, a ceramic material having a claimed coefficient of expansion of zero parts per million per degree centigrade. Another cavity was constructed completely of brass. It was intended to serve as a convenient test vehicle for oscillators and for the Cavity Q-Meter described below. The third and final cavity contains a silver-plated brass outer conductor, a silver-plated Vycor inner conductor, plus a compensation section designed to produce a first order correction for temperature effects on frequency. A Cavity Q-Meter has been constructed to permit studies of the coaxial cavities as passive resonators rather than as active parts of an oscillating system. This device features a frequency-swept oscillator, a variable-frequency oscillator, and a band-pass amplifier.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PRECISION FREQUENCY CONTROL TECHNIQUES (500 Mc AND HIGHER) by Vernon Crawford and Donald W. Fraser. Progress rept. no. 2, 1 May-1 Aug 53, on Contract DA 36-039-sc-42590. [1953] 49p. 11 refs.
Order from LC mi$3.30, ph$7.80 PB 138 185

A temperature-compensated cavity using an outer conductor of brass and an inner conductor of silver-plated Pyrex has been constructed and has been given extensive tests. This resonator, operating at a frequency of 300 megacyles, has exhibited an average frequency-versus-temperature change of about 0.5 parts per million per degree centigrade over a temperature range of seventy five degrees centigrade. A cavity has been constructed which utilizes a ceramic, Stupalith, having a claimed small (approximately zero) coefficient of expansion. Problems arising during silver-plating and during final assembly of the completed resonator have been discussed in detail. Cavity-controlled oscillators operating in the 500 megacycle range have been constructed and tested. In these oscillators the cavity serves as a reactive element. Further investigations of the high-order overtone responses of quartz crystal resonators have shown that some crystals may be excited at overtones as high as the fifty-ninth, and that the responses of various crystals are virtually independent of holder capacitance and of the Q of the holder. (See also PB 138 184)

Hughes Aircraft Co., Culver City, Calif.
SILICON TRANSISTOR, by J. S. O'Flaherty, M. Cutler and others. Final rept. for 1 Nov 53-31 Dec 54 on Contract DA 36-039-sc-56755, continuation of Contract DA 36-039-sc-42574. [1955] 71p. 19 refs. Rept. no. SC-14-F.
Order from LC mi$4.50, ph$12.30 PB 145 192

Research and development of silicon for semiconductor devices; and on semiconductor devices--primarily transistors--employing silicon. Improved techniques of silicon crystal growth and new methods of transistor fabrication, together with supplementary studies of silicon chemistry, silicon surface properties, and electrical characteristics, are described. (See also PB 137 354)

Johns Hopkins U., Baltimore, Md.
REPRESENTATION AND ANALYSIS OF SIGNALS. PART III. SIGNAL REPRESENTATION USING DIRAC'S NOTATION, by David C. Lai. Rept. on Contracts AF 19(604)1941 and Nonr-248(53). 31 Oct 58, 75p. 21 refs. AFCRC-TN-58-560; AD-160 869.
Order from LC mi$4.50, ph$12.30 PB 137 788

In this report, Dirac's Notation, originally applied by him to problems in quantum mechanics, is adopted and interpreted to provide a new representation of signals. Based upon the four operations most often encountered in the laboratory, viz., sampling, time reversing, filtering, and modulating, we introduce new compact symbols and operators to represent their mathematical counterparts, viz., sifting, tilding, convolution, and multiplication. In establishing any operation or equation, we have emphasized the physical and operational significance of the mathematics. The justification for this formulation depends, aside from its internal consistency, upon its ability to express compactly and concisely the various experimental processes used in analyzing signals.

Markite Co., New York.
INVESTIGATION OF CONDUCTIVE PLASTICS FOR USE IN BATTERIES, by Sidney A. Corren and Arnold S. Louis. Quarterly progress rept. no. 12 (Final) 15 Apr-Aug 57, on Contract DA 36-039-sc-64463. 15 Sep 57, 104p. Rept. no. 107-12.
Order from LC mi$5.70, ph$16.80 PB 144 917

Phase A: Continuation of work on improvement of stability, reproducibility and voltage life at 130°F of high voltage miniature molded batteries. Reported is a structure and a process for making sealed multiple cell battery stacks by machine assembly. Such stacks with magnesium anodes, conductive plastic cathodes and aqueous electrolyte exhibit more than 200 volts per cubic inch after 4 years of storage at 130°F. Phase B: A nickel-cadmium battery system with conductive plastic plates was investigated. Active battery plates were made by incorporating active material in porous conductive plastic. Characteristics of plates fabricated as continuous strip are described. Positive plates were produced which yielded 3 ah/cu in and negative plates with a capacity of 6 ah/cu in to a 1.0 v cut-off. BB403/U sized cells were made

which yielded 2 ah to 1.0 v at a 3a rate. Progress is reported in the direction if improved cycling life, volumetric capacity and voltage level at high discharge rate. (Author)

Melpar, Inc., Falls Church, Va.
RESEARCH STUDY OF THE CAPABILITIES AND LIMITATIONS OF CABLE BURYING TECHNIQUES IN THE MILITARY WIRE PLANT, by W. J. Bradley, M. J. Costello and others. Final rept. on Contract DA 36-039-sc-73130. 15 Jan 58, 148p. 112 refs. AD-153 115.
Order from LC mi$7.20, ph$22.80 PB 138 218

The history and development of cable burying is reviewed and recent military tests summarized. The resources required for the construction and maintenance of military cable lines by laying on the ground, installing aerially, and direct burial are developed from an evaluation of available information. An assumed basic situation is described to establish a basis for comparing characteristics of the 3 alternative methods of cable installation. An analysis is made of significant factors affecting the choice of installation method. The relative importance of cable burying in theaters of operations is discussed in the light of restrictions imposed by geography and the increased mobility of operational units. The probable use of cable in area grid systems is also examined. Commercial experience is examined for guidance in arriving at recommended techniques and procedures for military cable burial. Methods of analyses to be employed by signal officers in the field in determining the optimal method of construction of cable lines are covered. Means of controlling buried cable and a method of camouflaging a plow trace are discussed.

Michigan U. Research Inst., Ann Arbor.
DETECTION OF A SIGNAL SPECIFIED EXACTLY WITH A NOISY STORED REFERENCE SIGNAL, by T. G. Birdsall. Rept. on Contract AF 49(638)369. Sep 59, 29p. 5 refs. Technical rept. no. 93; 2803-1-T; AFOSR-TN-59-909.
Order from LC mi$2.70, ph$4.80 PB 144 784

This report treats the optimization problem of detecting the presence of a signal in a background of white Gaussian noise, under the restriction that the signal is specified exactly but the receiver memory contains only a noisy version of the signal. The optimum receiver is specified. The performances of both the optimum receiver and the crosscorrelation receiver with a noisy memory are calculated and compared for a special case. (Author)

Michigan U. Research Inst., Ann Arbor.
STUDIES IN RADAR CROSS SECTIONS 30. THE THEORY OF SCALAR DIFFRACTION WITH APPLICATION TO THE PROLATE SPHEROID, by R. K. Ritt, appendix by N. D. Kazarinoff. Scientific rept. no. 4 on Contract AF 19(603)1949, Aug 58, 54p. 21 refs. 2591-4-T; AFCRC-TN-58-351; AD-160 791.
Order from LC mi$3.60, ph$9.30 PB 137 831

It is shown that the inhomogeneous wave equation, $\nabla^2 u - u_{tt} = \rho\, e^{i\omega t}$, with prescribed initial conditions and subject to outer boundary conditions on a smooth closed surface, has a solution of the form $v(x,t)\,e^{i\omega t}$, and that $\lim_{T\to\infty} T^{-1} \int_0^T v(x,t)\,dt$ is given by the formula $\phi(x) = \lim_{s\to 0} \phi(x,s)$, where $\phi(x,s)$ is the solution of $\nabla^2\phi + (\omega - is)^2\phi = \rho$, subject to the same boundary conditions as u, and which is square-integrable in the exterior region. The theory of analytic resolvents of Sims and Phillips is applied to obtain a representation of the solution of this equation as a contour integral.

Microwave Lab., Stanford U., Calif.
BASIC MICROWAVE RESEARCH, by M. Chodorow. Scientific rept. no. 7, 1 Apr - 30 June 58, on Contract AF 19(604)1930. July 58, 14p. 1 ref. M. L. rept. no. 528; AFCRC-TN-58-360; AD-160 803.
Order from LC mi$2.40, ph$3.30 PB 137 862

Four projects are presently supported by this contract. In the electron velocity spectrograph project, much of the recent quarter's activity has been devoted to improvement in the experimental equipment. In the connected-ring structures project, work has continued on the design of a traveling-wave amplifier which is expected to produce between 25 and 50 kw peak power output at S-band. In the coupled-cavity-theory project, work has continued on the more detailed verification of the equivalent circuits which are now being used. The present equivalent circuit representation of the clover-leaf structure has succeeded in predicting a number of the characteristics actually observed with this circuit. In the electron gun studies project, the original gun design has been revised because of certain difficulties which were encountered with secondary emission and grid interception. (See also PB 137 681)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
FACTORS AFFECTING MICROWAVE ELECTRICAL BREAKDOWN AND TRANSMISSION NEAR MISSILE ANTENNAS, by R. M. Hill, A. J. Penico and others. Final rept. on Contract AF 19(604)3883. 28 Aug 59, 75p. 24 refs. AFCRC-TR-59-188.
Order from LC mi$4.50, ph$12.30 PB 144 544

Two experimental investigations have been made into intrinsic properties of atmospheric gases which affect microwave transmission. One experiment has measured the electron collision frequency for electrons of thermal energy in neon, nitrogen and oxygen. The method depends upon a measurement of the electron-cyclotron-resonance line width for thermal electrons. The other experiment has been a study of the rate of build up of electron density associated with the microwave pulse breakdown of air. The experiment was specifically designed to study attachment control in the pressure region of interest for missile antennas. A 10 cm cavity was used with the pulsed breakdown field applied to the TM_{010} mode.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
ELECTRONIC WARFARE APPLICATION OF MICRO-

WAVE ELECTRONICS, by John W. E. Griemsmann. Final rept. on Contract AF 30(602)1650. 7 July 59, 122p. 24 refs. Rept. R-743-59; PIB-671; RADC-TR-59-156.
Order from LC mi$6.30, ph$19.80 PB 144 861

Strip line high pass filters which can be fabricated completely by photoetching techniques have been developed for the frequency band from 100 to 1000 Mc/ sec. The short circuited terminations for the shunt lines used in earlier designs have been eliminated by the use of wide band open circuited shunt inductive structures. Series overlap capacitors were avoided by employing an alternative design procedure to yield a structure containing only transmission line sections. A narrow band bandpass filter employing coupled lengths of line to simulate the behavior of series inductors appears to exhibit desireable electrical and mechanical properties in the frequency range below 1000 Mc/sec. A savings in the overall size of the filter can be effected by coupling successive filter sections of this type through series capacitors. Other types of bandpass filters for the frequency band from 50 to 1000 Mc/sec. have also been considered. These include quarter wave coupled cavity types of filters and conventional strip line filter structures in low characteristic impedance lines.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
OPTIMUM TWO-TERMINAL INTERSTAGE DESIGN FOR HIGH-FREQUENCY TRANSISTOR AMPLIFIER, by W. H. Ku and H. J. Carlin. Rept. on Contract Nonr-839(05). 13 Feb 59, 64p. 5 refs. Rept. no. R-679-58; PIB-607.
Order from LC mi$3.90, ph$10.80 PB 144 821

The design of optimum two-terminal interstage is treated. In transistor feedback amplifier design, the most satisfactory interstage networks are two-terminal structures. For high-frequency transistors in cascade, we can consider the equivalent network to consist a shunt resistance-capacitance load in parallel with the two-terminal interstage structure. The problem is to design a coupling network to obtain maximum gain-bandwidth product consistent with physical realizability conditions of a two-terminal structure for the prescribed shunt R-C load. The theoretical limitations on the performance of the optimum two-terminal interstage are examined and three basic methods of design are given. It is concluded that the optimum gain-bandwidth of a two-terminal interstage is reduced by the presence of the shunt resistive element. Optimum gain-bandwidth characteristics are deduced and used to determine the shunt equalizer network. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
VARIABLE PARAMETER DELAY LINES, by G. Aaronson. Rept. on Contract Nonr-839(05). 13 Mar 59, 78p. 10 refs. Research rept. R-720-59; PIB-648.
Order from LC mi$4.50, ph$12.30 PB 145 149

This report is concerned with a study of the delay properties of networks containing several variable parameters. The effect of a parameter change on the delay function of the network yields information that aids in the synthesis of high order variable delay lines. The Bridged-T network is used as a prototype section in this investigation.

Minneapolis-Honeywell [Regulator Co., Philadelphia, Pa.]
DEVELOPMENT AND CONSTRUCTION OF MILITARY TYPE CRYSTAL OVENS, by E. Snitzer and R. Strong. Quarterly progress rept. no. 1 for 1 June-1 Sep 55 on Contract DA 36-039-sc-64622. [1955] 26p. B. I. rept. no. 9203-2.
Order from LC mi$2.70, ph$4.80 PB 145 222

The coexistence of the solid, liquid, and vapor phases of a substance, or the coexistence of only the solid and liquid phases under conditions of approximately constant pressure, insures the constancy of the temperature over wide ranges of heat exchange with the surroundings. A constant temperature oven can be designed which takes advantage of this type of thermal ballast.

Minneapolis-Honeywell [Regulator Co., Philadelphia, Pa.]
DEVELOPMENT AND CONSTRUCTION OF MILITARY TYPE CRYSTAL OVENS, by E. Snitzer and R. Strong. Quarterly progress rept. no. 2, 1 Sep-1 Dec 55, on Contract DA 36-039-sc-64622. [1955] 25p. B. I. rept. no. 9203-3.
Order from LC mi$2.70, ph$4.80 PB 145 223

Designs are discussed for ovens which are based on a solid-liquid system. The change in volume on phase change is detected by a bellows which operates a microswitch. The Class A oven is based on the use of the triple point temperature. The actuating mechanism is a float connected to a bellows whose movement controls the heater supply through a microswitch. (See also PB 145 222)

Minneapolis-Honeywell [Regulator Co., Philadelphia, Pa.]
DEVELOPMENT AND CONSTRUCTION OF MILITARY TYPE CRYSTAL OVENS, by E. Snitzer and R. Strong. Quarterly progress rept. no. 3, 1 Dec 55-29 Feb 56, on Contract DA 36-039-sc-64622. [1956] 17p. B. I. rept. no. 9203-4.
Order from LC mi$2.40, ph$3.30 PB 145 224

Preparation of pure para-dibromobenzene. The Class "B" oven designed for the HC-13 crystal holder was filled. The other Class "B" oven is in the process of being assembled. The detailed drawings on the Class "C" ovens were completed. (See also PB 145 223)

Minneapolis-Honeywell [Regulator Co., Philadelphia, Pa.]
DEVELOPMENT AND CONSTRUCTION OF MILITARY TYPE CRYSTAL OVENS, by R. C. Whitehead and R. K. Strong. Final rept. for 1 June 55-1 Oct 56 on Contract DA 36-039-sc-64622. [1956] 33p. B. I.

rept. no. 9203-6.
Order from LC mi$3.00, ph$6.30 PB 145 225

Three classes of crystal ovens were built utilizing paradibromobenzene at its melting temperature of 87.36°C as the thermostatic material. In this report the design construction and filling are discussed. The Class B and C ovens were within the temperature stability specification. The Class A ovens did not operate satisfactorily. (See also PB 145 224)

National Bureau of Standards, Boulder, Colo.
APPLICATION OF RF MICROPOTENTIOMETERS FOR CALIBRATION OF SIGNAL GENERATORS TO 1000 Mc, by L. F. Behrent. Jan 60, 19p. 2 refs. Technical note no. 37.
Order from OTS $0.50 PB 151 396

With the RF Micropotentiometer, signal generator output voltage can be calibrated to 1000 Mc simply and accurately if the procedures outlined in this paper are carefully followed. The sources of error are discussed and methods for minimizing or eliminating them are described. Topics discussed include: rf shielding, selection of a suitable rf detector, impedance matching and the proper selection of voltage reference planes. (Author)

Naval Ordnance Lab., Corona, Calif.
MAGNETIC RING TELEMETER DEVELOPMENT, by M. G. Pawley and T. B. Jackson. Feb 54, declassified 17 June 54, 27p. NOL-CORONA rept. 110.
Order from LC mi$2.70, ph$4.80 PB 144 747

The Magnetic Ring Telemeter is a multichannel pulse position modulated telemeter that utilizes small saturable reactors in place of vacuum tubes in the ring counter chains required in the transmitter premodulator to affect time division for the several channel pulses. A magnetic ring counter chain is also used in the receiver decoder for separating the channel pulses prior to recording of the transmitted intelligence. The development of the Magnetic Ring Telemeter was initiated for the purpose of providing a telemeter with increased intelligence-handling capabilities. The size was to be kept at a minimum and the reliability increased over former models by utilization of new techniques. The development has been reported periodically in the PETREL progress reports. A general description was presented at the 3rd National Telemetering Symposium sponsored by the Research and Development Board at Patrick Air Force Base, Florida, March 17, 1953.

Naval Ordnance Lab., Corona, Calif.
VHF MULTIPLE-SLOT FIN-TYPE AND MICROWAVE DIELECTRIC ROD ANTENNA ASSEMBLY, by D. E. Rowe, Ivan Rainwater, and D. A. Schriner. 31 Aug 59, 26p. 2 refs. NOLC rept. 467; NAVORD rept. 5966.
Order from LC mi$2.70, ph$4.80 PB 144 942

The Naval Ordnance Laboratory Corona has developed a fin-type multiple-antenna structure for mounting on a supersonic rocket sled. It provides four slot antennas for simultaneous signal transmission on four telemeter channels without mutual interference and a dielectric rod X-band antenna for receipt of command signals. The antenna assembly has given satisfactory performance under severe rocket-sled service conditions in the transmitting range of 215 to 235 Mc. It is believed that the design can be adapted to fulfill other special antenna requirements. (Author)

Naval Ordnance Test Station, China Lake, Calif.
FUZING APPLICATION OF THE FOUR-LAYER DIODE, by Duane J. Russell. 15 Sep 59, 33p. 3 refs. NOTS TP-2317; NAVORD rept. 6587; AD-228 825.
Order from LC mi$3.00, ph$6.30 PB 144 986

A new semiconductor device called the Shockley Four-Layer Diode has appeared recently on the market. Its electrical characteristics make the device of special interest for application to fuzing systems since it can perform both the operations of timing and energy switching. Energies of up to one million ergs can be switched using units with higher breakover voltages. A limited testing program indicated that the usefulness of the four-layer diode as a timer would probably be restricted by its temperature sensitivity. Testing programs also indicate that the diode can withstand at least 10 g vibration near its resonant frequency and a steady acceleration of at least 9,000 g. (Author)

Naval Research Lab., Washington, D. C.
RADAR TARGET ANGULAR SCINTILLATION IN TRACKING AND GUIDANCE SYSTEMS BASED ON ECHO SIGNAL PHASE FRONT DISTORTION, by D. D. Howard. Interim rept. 23 Dec 59, 12p. 8 refs. NRL rept. 5430.
Order from LC mi$2.40, ph$3.30 PB 143 942

The slope of the echo signal phase front from a finite-size complex target is identical to the angular error caused in tracking radars by target angle noise. Thus, the target angle noise is contained in the echo signal as a distortion of the phase front. This new concept aids in visualizing the source of target angle noise and in assessing, in general, the effects of target angular scintillation or target angle noise on any target locating device. As an example, identical errors in target location also occur in a search radar. (Author)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by H. E. Stauss. Status rept. no. 1, Feb 59, 124p. NRL Memo rept. 901.
Order from LC mi$9.90, ph$34.80 PB 145 601

New materials and new methods of preparation indicate that a survey of thermoelectricity at this time is desirable and hold out promise that the development of practical thermoelectric generators is possible. Practical applications of Peltier cooling is already a fact. Overall efficiencies of 20% to 35% appear to be within the realm of possibility. There is a high probability that the figure of 20% can be achieved. Actual work on new materials for generators has hardly been started in this country. Intensive efforts have been made to derive guide lines for materials development. From the strictly experimental side, several types of materials have shown promise.

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by H. E. Stauss. Status rept. no. 2, June 59, 56p. Memo. rept. 940.
Order from LC mi$3.60, ph$9.30 PB 145 602

In this report the material presented consists of: (1) the power to weight ratios of several thermoelectric generators, (2) the characteristics of thermoelements cooled by radiation, (3) the effect of increasing temperature upon efficiency, (4) materials data, and (5) changes and corrections in contracts. (See also PB 145 601)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by H. E. Stauss. Status rept. no. 3, Dec 59, 75p. 16 refs. Memo. rept. 969.
Order from LC mi$4.50, ph$12.30 PB 145 603

The progress on development of new materials is encouraging up to intermediate temperature levels. No results have yet been obtained from the small, early efforts to develop high temperature materials. Design and construction of the several generators on order is reported to be on schedule with no particular problems arising that were not anticipated. More efforts are now directed toward materials that will diffuse into the semiconductor with a minimum deterioration to the thermoelectric properties. Interest in nuclear powered thermoelectric generators is becoming more widespread, and efforts to explore material behavior in high energy environments are just starting. The materials data presented includes information of unusual interest on encapsulated materials. The results show the possibility of operating efficiently at appreciably higher temperatures than measurements have shown on material not enclosed. A review of Russian progress on thermoelectricity is presented as an Appendix. (See also PB 145 602)

New York U. Coll. of Engineering, N. Y.
AIR TRANSPORTABLE SHELTER FOR GROUND ELECTRONIC EQUIPMENT, by William D. Murray, Alan M. Nathan, and Harold Gussaroff. Rept. on Contract AF 30(602)205. 15 May 54, 129p. 51 refs. Technical rept. 222.05; RADC-TR-54-69; AD-43 896.
Order from LC mi$6.30, ph$19.80 PB 145 607

Analytical and experimental studies produced a shelter consisting of a structural framework with aluminum faced sandwich panels serving as walls, floors, and ceiling. Included are an air conditioning system, means for electronic shielding, and a mechanism for lifting the assembled shelter into or out of a flat bed truck or C-119 aircraft.

New York U. Coll. of Engineering, N. Y.
TRANSIENT RESPONSE AS A DESIGN CRITERION FOR STABILIZATION OF FEEDBACK AMPLIFIERS, by J. H. Mulligan, Jr. Rept. on Contract AF 49(638)586. Sep 59, 30p. 9 refs. Technical rept. 400-5; AFOSR-TN-59-1075.
Order from LC mi$2.70, ph$4.80 PB 144 770

A design criterion for use in the stabilization of feedback amplifiers is discussed which is concerned directly with pole locations and with a feature of the transient response. The criterion is the relative damping of the amplifier step-function response, i.e., the ratio of the deviations from unity in the normalized time response at two successive extreme values. Use of the proposed criterion in conjunction with a dominant term approximation to the transient response to formulate design equations for representative transistor and vacuum tube amplifier stages is demonstrated. Transient response curves for a particular design using various values of mid-band loop gain illustrate the effect of parameter changes on the stabilization design parameter. (Author)

Office of Scientific Research and Development. Div. 6.
RECOGNITION OF UNDERWATER SOUNDS. Summary technical rept. vol. 9 on [Contract OEMsr-1130] 1946, declassified 23 Apr 58. 291p. 185 refs. AD-200 787.
Order from LC mi$11.10, ph$45.60 PB 145 086

Contents:
The ear and hearing
  Structure of the ear
  Behavior of the ear
Listening
  Characteristics of target sounds and noise background
Laboratory measurements on masking of target sounds
Field measurements on masking of target sounds
  Summary of listening studies
Echo ranging
  Characteristics of echoes and reverberation
  Noise masking of echoes
  Reverberation masking of signals without doppler
  Reverberation masking of signals with doppler
  Summary of echo studies

Office of Scientific Research and Development. Div. 14.
SUPERSONIC DELAY LINES, by Herbert Shapiro (Radiation Lab., Mass. Inst. of Tech.). Rept. on Contract OEMsr-262. 15 Mar 46, declassified. 46p. 2 refs. Radiation Lab. rept 850.
Order from LC mi$3.30, ph$7.80 PB 137 822

The structural features of supersonic delay lines, together with some investigations bearing on their acoustic and electrical properties, are described. The lines were designed specifically for laboratory use as signal storage devices for an MTI (Moving Target Indication) system and have delays of the order of 0.5 to 1.6 milliseconds. (Author)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 2, 1 May-31 July 53, on Contract DA 36-039-sc-42670. [1953] 29p.
Order from LC mi$2.70, ph$4.80 PB 145 195

See PB 145 194.

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 3, 1 Aug-31 Oct 53, on Contract DA 36-039-sc-42670. [1953] 90p.
Order from LC mi$4.80, ph$13.80 PB 145 196

The aging curves of seventy crystal units have revealed three important characteristics. Heavily contoured 1000 Kc AT-cut units show a positive frequency shift followed by a stabilization. Third overtone 50 Mc plated crystals are negatively at a rapid rate with no indication of stabilization. There is very low aging of both fundamental 10 Mc and fifth overtone 50 Mc units wherein the quartz plates had been polished by optical methods. (See also PB 145 195)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 4, 1 Nov 53-31 Jan 54, on Contract DA 36-039-sc-42670. [1954] 135p.
Order from LC mi$6.90, ph$21.30 PB 145 197

Factors of evacuation, gas filling and sealing are of paramount significance in achieving low aging crystal units. The individual aging curves of 105 units are presented. (See also PB 145 196)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 5, 1 Feb-30 Apr 54, on Contract DA 36-039-sc-42670. [1954] 147p.
Order from LC mi$7.20, ph$22.80 PB 145 198

This report shows the aging characteristics of 103 crystal units. The gold evaporation plating problem has been resolved. The two most important factors in obtaining the required adhesion are freedom from crystal surface contamination and infra-red heating of the quartz plates to a temperature between 300°C and 400°C before plating. (See also PB 145 197)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 6, 1 May-31 July 54, on Contract DA 36-039-sc-42670. [1954] 125p.
Order from LC mi$6.30, ph$19.80 PB 145 199

This report contains actual aging curves for more than 125 units, with a brief description of the aging characteristics of each group. (See also PB 145 198)

Radio Corp. of America, Camden, N. J.
STUDY OF AGING EFFECTS ON MILITARY PLATED CRYSTAL UNITS, by E. M. Washburn. Quarterly progress rept. no. 7, 1 Aug-31 Oct 54, on Contract DA 36-039-sc-42670. [1954] 165p.
Order from LC mi$7.80, ph$25.80 PB 145 200

There appear to be three phases of aging effects. The initial deviation in frequency experienced by the majority of units is during the first month after fabrication. The second phase covers a period of about six months and is characterized by a tendency towards frequency stabilization. The third phase is a retarded effect, not greatly influencing crystal unit performance until six or seven months after fabrication and exposure to an elevated temperature such as +75°C. Latest techniques in lapping, etching, plating and mounting of the crystal units currently being produced. (See also PB 145 199)

Radio Corp. of America, Somerville, N. J.
INDUSTRIAL PREPAREDNESS STUDY ON DEVICE 1, by J. E. Wright and P. A. Wemett. Quarterly rept. no. 2, 1 Nov 57-31 Jan 58, on Contract DA 36-039-sc-72709. 1 Apr 58, 22p. AD-160 634.
Order from LC mi$2.70, ph$4.80 PB 138 053

Both p-n-p and n-p-n versions of device 1 are being developed to meet Spec MIL-T-19500A. Both versions are being fabricated.

Radio Receptor Co., Inc., Brooklyn, N. Y.
INDUSTRIAL PREPAREDNESS STUDY ON SILICON JUNCTION CRYSTAL DIODES, by William E. Harding and Melvin Klein. Final engineering rept. on Contract DA 36-039-sc-70264. [1958] 225p. AD-161 315.
Order from LC mi$9.90, ph$24.80 PB 138 096

The developmental history, design, construction, electrical characteristics, and pilot line manufacturing process are discussed for the 1N658 glass-encapsulated, Si junction diode. The diode has high forward conductance, fast reverse recovery, and low leakage at room and elevated temperatures. The basic rectifying structure is a p-n-n+ assembly consisting of an n-type Si die with an Al wire alloyed to one surface to form the p-n junction; an Sb-doped Au disk is alloyed to the opposite side to form the n-n+ junction. External connections consist of a Dumet lead spot welded to the Al wire and a Dumet lead soldered to a Kovar disk. The leads are hermetically sealed in a glass capsule which is evacuated. A pilot production yield of 25% was obtained for the diode. (See also PB 132 079)

Raytheon Mfg. Co., Newton, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE, by Frank M. Dukat and George Freedman. Quarterly rept. no. 9, 28 Mar-28 June 57, on Contract DA 36-039-sc-66038. [1957] 72p. AD-159 993.
Order from LC mi$4.50, ph$12.30 PB 138 050

The stability resulting from packaging processes was investigated. The use of SR-98 base coat required DC-4 silicone grease or other protective processing to eliminate the collector diode current (Ico) and the floating potential (V_{if}) problems encountered in environmental testing. Exhausting of the weld gases and solder sealing in a nitrogen atmosphere did not reduce the I_{CO} problem. The change from the type E to the type 30 package in itself produced no significant change in in-line yields. Two package processing experiments showed that if no base coat, or silicone

grease or oil is used, high in-line rejection levels occur for I_{co} and V_{if}. Units packaged with 50% SR-98 base coat and DC-4 silicone grease applied around the unit resulted in the highest in-line yields coupled with the best over-all stability. (See also PB 138 094)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
NEW METHOD OF MEASURING THE NOISE PARAMETERS OF THE ELECTRON BEAM, ESPECIALLY THE CORRELATION BETWEEN ITS VELOCITY AND CURRENT FLUCTUATIONS, by Shigebumi Saito. Rept. on Contract DA 36-039-sc-64637. 22 Aug 57, 52p. 8 refs. Technical rept. no. 333; AD-201 537.
Order from LC mi$3.60, ph$9.30 PB 145 132

The noise figure of a microwave beam amplifier has a lower limit that depends entirely upon the noise process in the electron gun at and near the potential minimum. This report is chiefly concerned with the theory and experimental results of a new method of measuring the noise parameters of the electron beam, especially the correlation between its velocity and current fluctuations, by using a selective beam coupler that has properties similar to the conventional microwave directional coupler. The value of the correlation coefficient of the velocity and current fluctuations was found to be from 0.2 to 0.35 in the space-charge-limited region and zero, or slightly negative, in the temperature-limited region. The probable error of this measuring method is discussed by taking account of the residual selectivity of the selective beam coupler, the effect of the pickup cavities upon the beam, the thermal noise from these cavities, and the higher-order modes.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
A STUDY OF ASYNCHRONOUS LOGICAL FEEDBACK NETWORKS, by Stephen H. Unger. Doctoral thesis. Rept. on Contract DA 36-039-sc-64637. 26 April 57, 47p. 13 refs. Technical rept. no. 320; AD-150 502.
Order from LC mi$3.30, ph$7.80 PB 145 436

The systems considered are asynchronous, dc-level, sequential switching circuits; that is, there are no clock pulses, and the signals are represented, not by pulses, but by variables that can assume values in either of two nonoverlapping ranges. The analysis of these circuits is discussed, with emphasis on the problem of choosing state variables. A relationship has been established between the number of rows of a reduced flow matrix and the feedback index of the associated circuit and, furthermore, the need for amplification around each feedback loop has been proved. The major portion of the research is devoted to a study of the effects of stray delays on the operation of sequential switching circuits.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
THEORY OF LOW-DISTORTION TRANSMISSION OF FM SIGNALS THROUGH LINEAR SYSTEMS, by Elie J. Baghdady. Rept. on Contract DA 36-039-sc-64637. 30 July 57, 50p. 10 refs. Technical rept. 332.
Order from LC mi$3.30, ph$7.80 PB 145 340

The convergence properties of the Carson and Fry and of the van der Pol-Stumpers expansions for the complex amplitude of the steady-state response of a filter to an FM excitation are discussed. The theory of quasi-stationary analysis and of FM-to-AM conversion with low distortion is presented. The use of Taylor's formula leads to error estimates and to a simple condition that specifies an upper bound on the error incurred in restricting the solution to the quasi-stationary term (the instantaneous-frequency method). A sluggishness ratio and an index of stiffness are defined for filters whose system functions have poles only in the left half-plane. Sluggishness ratios and indices are given for various filters of wide practical interest.

Sage Labs., Inc., Wellesley, Mass.
INVESTIGATION INTO THE DESIGN OF ROTATING MECHANICAL PHASE SHIFTING DEVICES, by Jay J. Chacran and Theodore S. Saad. Final rept. on Contract AF 19(604) 1844. 31 Dec 58, 51p. AFCRC-TR-59-156; AD-216 764.
Order from LC mi$3.60, ph$9.30 PB 145 301

The advent of more complicated antenna systems has lead to the need for various components that make such systems practical. One of these components, a continuous phase shifter, is described. This phase shifter operates over the 400- to 440-mc band with VSWR$\leq$1.13, insertion loss$\leq$0.8 db, rotational variation$\leq$0.3 db, and deviation from phase linearity $\leq +$ 7.0 to -3°.

Stanford Electronics Labs., Stanford U., Calif.
A CLASS OF SYSTEMATIC CODES FOR NON-INDEPENDENT ERRORS, by N. M. Abramson. Technical rept. no. 51 on Contract Nonr-225(24). 30 Dec 58, 35p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 144 933

A class of systematic codes has been obtained which will correct all single errors and all double errors which occur in adjacent digits. These codes use significantly fewer checking digits than codes which correct all double errors. In addition, because of inherent regularities in their structure, these codes may be instrumented in a strikingly simple fashion. (Author)

Stanford Electronics Lab., Stanford U., Calif.
AN INVESTIGATION OF THE MAGNETRON AMPLIFIER, by B. A. Wightman. Technical rept. no. 52 on Contract Nonr-225(24). 9 Feb 59, 99p. 32 refs. AD-211 869.
Order from LC mi$5.40, ph$15.30 PB 144 812

The magnetron amplifier is investigated because of its promise of efficiencies in excess of fifty percent. Two problems are dealt with: an analytical investigation of the interaction at small signal levels, and an experimental effort to adapt the zig-zag line for the higher power requirements in the magnetron amplifier. The model for the space-charge effects

postulated by Heffner and Unotoro is inserted into the Pierce analysis of the magnetron amplifier. The result includes a determinantal equation for the space-charge-wave interaction which is the same as Gould's, but the analysis embraces all interactions. These interactions are examined with respect to the energy exchange between beam and circuit in order to determine which interactions are useful. The selection of a slow-wave circuit for the magnetron amplifier is discussed, and the zig-zag line is chosen for its low dispersion. This circuit was adapted for higher powers by mounting on a ceramic of high thermal conductivity which was undercut to minimize dielectric loading. The circuit thermal capacity was satisfactory, but the effect of the undercutting was not as great as anticipated. The coupling impedance was reduced and the attenuation increased excessively for a high-efficiency application. An experimental amplifier using this circuit had an efficiency of only twelve percent. (Author)

Stanford Electronics Labs., Stanford U., Calif.
PHYSICAL PRINCIPLES OF AVALANCHE TRANSISTOR PULSE CIRCUITS, by D. J. Hamilton, J. Gibbons and W. Shockley. Technical rept. no. 53 on Contract Nonr-225(24). 17 Feb 59, 22p. 6 refs.
Order from LC mi$2.70, ph$4.80 PB 144 811

A simple physical theory is developed which permits a calculation of the significant points of avalanche transistor transient behavior. A model for the transistor is defined in terms of charge variables and the physical parameters of the device. The transient performance of the model is calculated by focusing attention on the minority carrier charge stored in the base region and the influence of base-width modulation upon this stored charge. In the charge formulation of the problem the physical details of the avalanche multiplication process need not be considered; multiplication is accounted for by the boundary conditions which it imposes upon the stored charge. Good agreement has been obtained between calculated and experimentally observed data for a simple avalanche transistor relaxation oscillator. (Author)

Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF PRINTED CIRCUIT ECM ANTENNAS, by E. M. T. Jones. Final rept. for 1 Dec 55-15 Aug 58 on Contract AF 19(604)1571. July 58, 12p. AFCRC-TR-58-176; AD-160 817.
Order from LC mi$2.40, ph$3.30 PB 137 448

Summaries are given of studies in the following categories: novel types of printed circuit driving elements, wideband radiating structures, and modulated surface-wave antennas. Novel types of wideband driving circuits are being investigated which can be constructed by printed circuit techniques and have particular application to ECM antennas. These circuits included strip-line 3-db directional couplers, broadband 90° phase shifters, and wideband baluns. The studies of wideband radiating structures were concerned with flush-mounted leaky-wave antennas, printed-circuit zig-zag radiators, and dielectric-filled ECM-horn antennas.

[Stelma, Inc., Stamford, Conn.]
DEVELOPMENT AND CONSTRUCTION OF REPEATER, TELEGRAPH TH-18( )/FG, by L. M. Carver. Final rept. for 23 June 53-26 Jan 57 on Contract DA 36-039-sc-52675. [1957] 127p. AD-126 100.
Order from LC mi$6.30, ph$19.80 PB 145 193

The purpose of the contract is to develop a general purpose electronic regenerative repeater to correct dc teleprinter signal distortion and improve transmission on wire and radio circuits and to produce 13 service test repeaters after tests were performed on the first two prototypes. Specifications for the equipment are outlined in Technical Requirement SCL-1436. A breakdown of tasks in the job can be made generally following circuit sections of the equipment as follows: (A) Packaging; (B) Input circuits; (C) Timing circuits; (D) Synchronous circuits; (E) Sampling circuits; (F) Output circuits and (G) Power Supply circuits.

Technische Hochschule, Munich (West Germany).
WAVE PROPAGATION AND OSCILLATIONS IN PLASMA BODIES, by W. O. Schumann. Technical final rept. for 1 Apr 58-31 Mar 59 on Contract AF 61(052)79. [1959] 44p. 11 refs. AD-225 053.
Order from LC mi$3.30, ph$7.80 PB 145 170

The propagation of electromagnetic waves and appearances of oscillations in a coaxial cable, the inner conductor of which was a plasma, were investigated under the influence of an external longitudinal magnetic field and the results were compared with the theory. (Author)

Transitron Electronic Corp., Wakefield, Mass.
THE FABRICATION OF SILICON CARBIDE JUNCTIONS, by Karl M. Hergenrother. Scientific rept. no. 1 on Contract AF 19(604)4989. 5 Nov 59, 13p. AFCRC-TN-59-960.
Order from LC mi$2.40, ph$3.30 PB 144 974

It has been found possible to grow P-N junctions in silicon carbide by depositing a single crystal film from the vapor phase onto a silicon carbide seed. The junction is made by adding impurities to the ambient gas in the furnace during the crystal growth. These P-N junctions are suitable for fabricating diodes and other junction devices which will operate at 500°C and have relatively good resistance to high energy radiation.

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICES, by J. C. Helmer, H. S. Weaver and others. Quarterly rept. no. 4, 1 Apr-30 June 58, on Contract DA 36-039-sc-73266. [1958] 33p. 8 refs. Engineering rept. no. 218-4Q.
Order from LC mi$3.00, ph$6.30 PB 145 232

Measurements have been completed on the new parabolic beam focuser. The results show that at a given power output the molecular flow rate is reduced by a factor of eight, and at maximum power output the power has been increased by a factor of 2.5. An experiment is described which conclusively shows

that paramagnetic resonance in $BaTiO_3$ is a volume rather than a surface effect.

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICES, by J. C. Helmer, R. C. Rempel and others. Quarterly rept. no. 5, 1 July-30 Sep 58, on Contract DA 36-039-sc-73266. [1958] 43p. 23 refs. Engineering rept. no. 218-5Q.
Order from LC mi$3.30, ph$7.80 PB 145 233

Research in molecular beam masers has included the investigation of noise in quantum mechanical systems, the frequency-mixing properties of quantum mechanical systems, and the determination of methods for improving maser performance and reducing the threshold beam intensity required for oscillation. In the solid-state maser program, it has been shown that $SrTiO_3$ containing an Fe^{3+} impurity is a suitable material for a zero field, three-level maser. Methods have been developed for growing single crystals of $BaTiO_3$ and $SrTiO_3$. (See also PB 145 232)

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICES, by J. C. Helmer and H. E. Weaver. Quarterly rept. no. 6, 1 Oct-31 Dec 58, on Contract DA 36-039-sc-73266. [1958] 38p. 17 refs. Engineering rept. no. 218-6Q.
Order from LC mi$3.00, ph$6.30 PB 145 234

A summary of the dielectric properties of $SrTiO_3$ at low temperatures is included. Equations are set up for the design of molecular beam masers with prescribed characteristics. It is shown that it is necessary to compromise between molecular Q and power output. The problems of detecting oscillation are considered, and solutions are proposed for novel types of particle and photon detectors. (See also PB 145 233)

Westinghouse Electric Corp., Boston, Mass.
RESEARCH ON SILICON CARBIDE TRANSITORS. Scientific rept. no. 4, 15 Jan-15 July 59, on Contract AF 33(616)5592. [1959] 42p. 5 refs. AFCRC-TN-59-951.
Order from LC mi$3.30, ph$7.80 PB 144 975

Boron-tin-platinum alloy was found to be promising for forming p-n junctions in n-type silicon carbide. The rectification ratios for the fused junctions were higher for higher fusion temperature and greater temperature gradient normal to the regrowth layer.

Westinghouse Research Labs., Pittsburgh, Pa.
SYNTHESIS AND PURIFICATION OF DIELECTRIC MATERIALS, by T. W. Dakin, R. N. Wenzel and others. Rept. for 1 July 58-30 June 59 on Electrical and Electronic Materials, Contract AF 33(616)5979. Oct 59, 141p. 37 refs. WADC Technical rept. 59-337, Pt. 1.
Order from OTS $2.75 PB 161 366

This project seeks to improve the dielectric properties in inorganic insulating materials, for use at 500°C through rigorous exclusion of impurities. Results to date with boron nitride, alumina, silica and reconstituted mica are presented. Methods of synthesizing the pure materials and preparing test specimens without contamination are described. Dielectric measurements are reported over the temperature range 25° to 500°C and at frequencies 60, 10^3 and 10^5 cycles per sec. Boron nitride prepared from purified chemicals showed lower low frequency dissipation factors and higher resistances at 500°C than have heretofore been reported for any known material. With alumina, the high temperature dielectric properties of the best single crystal sapphire examined were equalled and somewhat surpassed. Little improvement could be effected, however, in reconstituted mica through purification by dialysis or electrodialysis. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
A CALIBRATED SHAKE TABLE FEATURING LINEAR AIR SPRING SUSPENSION, by James H. Prout, John W. Wescott, and William H. Follett. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Aug 58, 15p. 2 refs. Rept 2144-309-T.
Order from LC mi$2.40, ph$3.30 PB 145 120

In an electromechanical transducer designed especially for calibration of geophones wide frequency response is made possible by the use of feedback within the driver amplifier and over-all feedback from a sampling coil mounted on the moving platform. An adjustable "air spring" accommodates static loads up to 30 pounds. Integration of the shaker with a complete automatic calibration system is described. (Author)

Ordnance, Missiles, and Satellite Vehicles

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A STUDY OF THE SATELLITE EQUATIONS OF MOTION AND TRANSFER ORBITS, by Lynn E. Wolaver. Dec 58, 174p. 3 refs. WADC Technical note 58-378; AD-215 854.
Order from LC mi$8.10, ph$27.30 PB 144 858

The equations of motion are derived for a satellite moving about a spherical earth and subject to a direct or retro-grade impulse thrust. The cases of direct thrust to lengthen the apogee and retro-grade thrust to initiate re-entry into the earth's atmosphere are considered. Direct thrust values needed to obtain a given apogee are found and presented graphically. Thrust errors in magnitude and alignment angle are considered. For the retro-grade thrust at apogee, the re-entry velocity, re-entry angle, and re-entry distance from apogee are determined and shown graphically. The effects of thrust errors both in magnitude and misalignment angle, including the radial thrust case, are derived and shown in graphs. The same quantities are also found for the case of retro-grade thrust applied at perigee. The general transfer orbit case is considered. Given any initial elliptical orbit and a point on that in terms of its

angular distance from apogee, and given the thrust components to be applied at that point, then the re-entry velocity and re-entry angle may be found by a simple graphical solution. Use is made of relationships in the energy-angular momentum plane. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
SPACE PROBES AND PERSISTENCE OF STRONG TROPOPAUSE LEVEL WINDS, by H. Salmela and N. Sissenwine. Dec 59, 15p. 1 refs. GRD Research notes no. 26; AFCRC-TN-59-652.
Order from OTS $0.50 PB 161 431

When current military missiles are used as boosters of scientific space probes, additional components required for certain experiments will result in missile configurations which are more critical to strong tropospheric wind profiles than for the basic military missile. The persistence of certain critical tropopause-level Cape Canaveral-Patrick Air Force Base wind speeds is investigated. The probabilities of various durations are presented in tables. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
DETERMINATION OF RADIANT ENERGY REQUIREMENTS FOR PHOTOGRAPHIC SPACE VEHICLE TRACKING, by Thomas P. Rona. Nov 59, 19p. 3 refs. AFMDC-TN-59-31.
Order from LC mi$2.40, ph$3.30 PB 144 978

Photographic tracking, known to supply far better accuracy in angular resolution than conventional CW and pulsed microwave radar techniques, is not in widespread use for missiles and artificial satellites mainly because it lacks appropriate flash transponders. It is shown that the signal-to-noise ratio is, for optical tracking in clear atmosphere, at least equal to, but often superior to, radar communication; it is further shown that techniques for vehicle-borne flash sources are within the state of the art, and finally that star background reference can be made available for increased absolute accuracy. Daylight optical tracking is possible with optics of sufficient aperture. (Author)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
THEORETICAL ANALYSIS OF DOPPLER RADIO SIGNALS FROM EARTH SATELLITES, by William H. Guier and George C. Weiffenbach. Rept. on Contract NOrd-7386. Apr 58, 64p. 12 refs. Bumblebee series rept. no. 276; AD-162 756.
Order from LC mi$3.90, ph$10.80 PB 145 144

This report describes a method of determining the orbit of an artificial satellite from measurement of the Doppler shift of its radio signals.

Army Chemical Warfare Labs., Army Chemical Center, Md.
E15R1 COLORED-SMOKE GRENADE (FOR USE IN AIRBORNE OPERATIONS) by Woodrow W. Reaves and Kenneth G. Carlon. Sep 58, 40p. 1 ref. CWL Special pub. 1-5.
Order from LC mi$3.00, ph$6.30 PB 138 342

The object of the work described in this report was to develop a colored-smoke grenade suitable for use as a pathfinder aid in airborne operations.

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
ROCKET FLIGHT AND EARTH SATELLITE ORBITS, by James E. Norman. 1 July 58, 32p. 6 refs. Rept. no. 2R28p; AD-200 412.
Order from LC mi$3.00, ph$6.30 PB 145 618

The problem of rocket propulsion of an earth satellite into orbit is analyzed, utilizing Kepler's laws for description of orbital parameters. The motion of the rocket during powered flight is treated subject to certain simplifying assumptions, and final vehicle energy related to orbital energy. Examples of hypothetical satellite missions are given. (Author)

Avco Research Lab., Everett, Mass.
REDUCTION OF FLIGHT TIME AND PROPELLANT REQUIREMENTS OF STAELLITES WITH ELECTRIC PROPULSION BY THE USE OF STORED ELECTRICAL ENERGY, by Morton Camac. Rept. on Contract AF 49(638)61. Oct 58, 28p. 8 refs. Research rept. 36; AFOSR-TN-58-1013; AD-206 156.
Order from LC mi$2.70, ph$4.80 PB 138 439

This paper analyzes flight plans for satellites having a lower thrust than the local gravitational forces. The minimum impulse plan to go from a low circular orbit to a high altitude orbit is accomplished with the Hohmann transfer ellipse which requires two short impulses. It will be shown that electrical propulsion can also use impulse and still have a complete utilization of the available energy when energy storage is incorporated in the propulsion system. The extent to which this electrical storage is useful for reducing the flight time and propellant consumption is the subject of this paper.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPLOSION IN WIND TUNNEL AIR LINE, by T. L. Smith. Sep 59, 20p. 2 refs. Memo. rept. no. 1235.
Order from LC mi$2.40, ph$3.30 PB 144 901

On 10 February 1959 a pipe line carrying compressed air at 750 psi exploded in two places. The air had been contaminated with oil. This report covers the explosion, and some pertinent facts learned as a result of the ensuing investigation. Total damage will be about $250,000. (Author)

Directorate of Labs., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EFFECTS OF SMALL CHANGES IN POSITION AND VELOCITY AT BURNOUT ON THE ORBIT OF A BALLISTIC MISSILE, by Edouard E. Perret and

John C. Corbin, Jr. Oct 59, 33p. WADC Technical note 59-336.
Order from OTS $1.00 PB 161 409

The effects of small changes in position and velocity at burnout on the orbit of a ballistic missile have been examined. It is shown that assumed spherical distributions of error in position or velocity at burnout propagate as error ellipsoids of position of increasing eccentricity with time. The results can be used to assess the accuracy required in establishing the position and velocity of the missile at burnout (1) to accomplish interception at various points on the orbit (defensive sense), or (2) to achieve a desired CEP at impact (offensive sense). In addition, the relative motion of closely spaced missiles and/or decoys having the same or slightly different velocities can be examined. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF TEST APPARATUS TO MEASURE SHOCK PROTECTION OFFERED BY PACKAGING TO MISSILE COMPONENTS, by George Zell. Aug 59, 9p. Final engineering rept. FR: 1-60.
Order from LC mi$1.80, ph$1.80 PB 144 737

The extremely high cost and shock sensitivity of complex missile system components necessitates elaborate and expensive protective packaging to eliminate damage from shocks sustained in transit. Since the shock response of components, containers and isolation systems is a function not only of shock magnitude, but also of the duration and waveshape of the shock, the laboratory shock apparatus must be capable of reproducing all three parameters as they occur in the environments. A survey of the shock simulation systems currently available indicated that the HYGE shock tester most closely met the performance criteria that had been established through extensive study of transportation shock data.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DYNAMIC TESTING OF CUSHIONING MATERIALS FOR PACKAGING, by Theodore Fruchtman and Samuel A. Gee. Final engineering rept. Aug 59, 6p. 1 ref. FR: 2-60.
Order from LC mi$1.80, ph$1.80 PB 145 152

This assignment is related to the general object of improving sensitive devices, by the consideration of packaging to protect the devices during transportation and handling. Specifically, cushioning material of various kinds and dimensions, were tested and information compiled for the determination of optimum efficiency and economy in reducing the shock below the breaking point or fragility factor of the item to be packaged. Resultant data were recorded and charted. Incidentally, improvements were made in the original test equipment specified for this work. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
GAS GENERATOR FOR THE E120 BOMBLET, by Arthur Graff. Dec 59, 29p. 2 refs. Technical rept. 2633.
Order from LC mi$2.70, ph$4.80 PB 145 151

An igniter composition and an intermediate composition were developed for ignition of the gas-generating propellant composition for use in the E120 bomblet. The igniter contains barium chromate (78.2%), zirconium (20.8%), and vinyl alcohol-acetate resin (1.0%). The intermediate is a 50/50 mixture of the igniter and the propellant. A one-piece molded plastic insulator cup was developed. A technique for loading the igniter, intermediate, and propellant compositions as a single increment was devised. A test fixture of the liquid pressurizer type was designed, fabricated, and used in testing the gas generator. Functioning characteristics of the gas generator in the test fixture were established. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
MALFUNCTION OF A TNT-LOADED 155 MM M101 HE SHELL AT THE PUEBLO ORDNANCE DEPOT, by Samuel D. Stein. Nov 58, 22p. 17 refs. Technical rept. 2585.
Order from LC mi$2.70, ph$4.80 PB 138 348

Frankford Arsenal, Philadelphia, Pa.
A THEORETICAL INTERIOR BALLISTIC STUDY OF RECOILLESS HIGH-LOW-PRESSURE GUNS, by D. J. Katsanis. June 59, 55p. 17 refs. Rept. R-1513.
Order from LC mi$3.60, ph$9.30 PB 144 977

The general theory of high-low-pressure recoilless guns is derived and discussed. Analytical solutions are obtained for the high-pressure section; performance stability is evaluated for tubular and cord shaped propellant grains with a linear burning rate and for tubular grains with a plateau type burning rate.

General Electric Co., Schenectady, N. Y.
COMPLETE MISSILE: - NORMAL FORCE COEFFICIENTS AND CENTER OF PRESSURE, by Otto Klima, Jr. and Margaret A. Lavelle. 28 Oct 52, declassified, 4p. Hermes A-3B Aero Data memo. no. 14B.
Order from LC mi$1.80, ph$1.80 PB 145 080

In addition to the slightly revised curves here recommended for the chosen fin size (58" root chord) all available test points are also shown. The tests were made, however, only for models representing 50" and 60" fullscale fins.

[General Electric Co., Schenectady, N. Y.]
EFFECT OF LARGE PITCH ANGLES ON STATIC STABILITY IN YAW FOR SMALL YAW ANGLES, by Otto Klima, Jr. and Helen C. Engvold. 27 Oct 52, declassified. 5p. Hermes A-3B Aerodynamic data memo. 14C.
Order from LC mi$1.80, ph$1.80 PB 144 888

Results of wind-tunnel tests recently conducted at

Aberdeen at M = 3.80 and 2.47 to determine the effect of large angles of attack (in pitch) on the center of pressure in the yaw plane, for small yaw angles, are presented.

General Electric Co., Schenectady, N. Y.
FORCE AND BENDING MOMENT IN PLANE OF FIN, by R. B. Chamberlin. 5 Feb 54, declassified. 1p. 2 refs. Hermes A-3B Aerodynamic data memo. no. 11F.
Order from LC mi$1.80, ph$1.80 PB 145 081

This memorandum supplements the other memorandums in this series. The maximum and nominal forces and bending moments on one fin are presented for power-on and power-off flight. The force vector is contained in the plane of the fin and also in a plane which is perpendicular to the plane of the fin and is parallel to the body axis. The bending moment is in the plane of the fin and is measured about the intersection of the hinge line and the body skin. These data are pertinent to a test of a fin actuator under flight conditions.

General Electric Co., Schenectady, N. Y.
MAXIMUM TAIL LOADS DURING POWERED FLIGHT, by R. B. Chamberlin. 31 Dec 53, declassified. 1p. 4 refs. Hermes A-3B Aerodynamic data memo. no. 11E.
Order from LC mi$1.80, ph$1.80 PB 145 082

The maximum load (including tolerances stated below) normal to the missile axis on one fin is 5250 pounds for A-3B missiles having command guidance equipment with a maximum output as specified in reference 1 and launched under fair weather conditions at White Sands Proving Grounds.

Metallurgical Research Labs., Syracuse U. Research Inst., N. Y.
COMPOSITE MATERIALS AND COMPOSITE STRUCTURES: PROCEEDINGS OF THE SAGAMORE ORDNANCE MATERIALS RESEARCH CONFERENCE [NO. 6] AT SAGAMORE CONFERENCE CENTER, RAQUETTE LAKE, NEW YORK, AUGUST 18, 19, 20, 21, 1959. Rept. on Contract DA 30-069-ORD-2566. [1959] 561p. 78 refs. MET661-601.
Order from OTS $7.00 PB 161 443

Contents:
Composite materials and structures, present and future
Aspects of strengthening of composites
Metallic composites
Glass reinforced plastics
Composite pressure vessels
Composite systems for thermal protection

Naval Avionics Facility, Indianapolis, Ind.
STATISTICAL METHODS IN AIRBORNE FIRE CONTROL THEORY. ERROR STUDIES, by Melvin D. Springer. 8 Apr 57, 66p. 3 refs. NAFI-TP-15; AD-129 382.
Order from LC mi$3.90, ph$10.80 PB 144 663

A study is made of mechanization and input errors which arise in connection with a fire-control system. Two methods of evaluating mechanization error are explained: (1) the errors which occur when each component unit alone is malfunctioning are calculated and then combined statistically to determine a confidence interval for the system output error which applies when all component units are malfunctioning simultaneously; and (2) the component errors are considered simultaneously and the resultant error in the output of the system is evaluated by calculating a total differential. The procedures involve static or dynamic methods of error analysis, respectively. The errors in the system output caused by input errors are also analyzed by these methods. If the combined effect of mechanization error and input error are analyzed, the methods may be employed provided the 2 types of errors are mutually independent.

Naval Ordnance Lab., Corona, Calif.
THE NOLC ROCKET SLED AS A SUPERSONIC ENVIRONMENT SIMULATOR, by D. E. Rowe, J. L. Day, and L. H. Witbeck. 27 Aug 59, 32p. 5 refs. NAVORD rept. 5967; NOLC rept. 468.
Order from LC mi$3.00, ph$6.30 PB 144 988

The NOLC Rocket Sled was designed and built by the Naval Ordnance Laboratory Corona as a research test vehicle for use on the Supersonic Naval Ordnance Research Track (SNORT) at the Naval Ordnance Test Station, China Lake, Calif. It provides NOLC with a reliable means for the supersonic environment testing of guided missile components and ordnance items during their development and evaluation stages. It is believed that the design ideas incorporated in the sled can be adapted to the needs of other activities interested in building test vehicles for similar purposes. (Author)

Naval Weapons Lab., Dahlgren, Va.
WATER IMPACT TESTS OF THE MOD 6 AND MOD 7 DATA CAPSULE, FINAL REPORT, by D. W. Culbertson. Final rept. 4 Nov 59, 83p. 8 refs. NWL rept. no. 1681.
Order from LC mi$4.80, ph$13.80 PB 144 983

The Mod 6 and Mod 7 Data Capsule and its payload will reliably survive water impact at terminal velocities of 450 ft/sec when impacted within the spherical sector defined respectively for the Mod 6 by a 16.9" and for the Mod 7 by a 18" diameter circle on the lower hemisphere of the capsule. Separation and breakaway of the shell fragments do not occur until after complete penetration by the capsule. (Author)

Springfield Armory, Mass.
COMPARATIVE EVALUATION OF CHROMIUM PLATED M14 RIFLE BARRELS FABRICATED FROM CHROME-MOLY-VANADIUM STEEL AND ORD 4150 RESULPHURIZED STEEL, MIL-S-11595(ORD), by T. P. Jones, S. D. Caloccia and others. 3 Aug 59, 88p. SA-TR11-2621.
Order from LC mi$4.80, ph$13.80 PB 144 924

Results of erosion tests, and standard and accelerated firing tests for both materials were satisfactory. Bore damage for both materials was nearly equal. In view of known potential savings, use of ORD 4150 resulphurized steel is recommended.

Sanitation and Safety Engineering

Army Chemical Warfare Labs., Army Chemical Center, Md.
HABITABILITY OF A DIFFUSION-TYPE PROTECTIVE SHELTER IN SUMMER WEATHER (KIT, CONVERSION, MEDIUM G. P. TENT, PROTECTIVE SHELTER, E21) by F. N. Craig and P. J. Edgar. Aug 59, 29p. 18 refs. CWLR-2300.
Order from LC mi$2.70, ph$4.80 PB 144 683

The E21 protective shelter kit provides an assembly for a protective shelter within a tent to permit 10 to 12 men to function without personal protective equipment during a CBR attack. A physiological assessment of the shelter is described. The method involved placing 12 subjects within the shelter for 7 to 8 hours on 2 days and 3 subjects for the same period on one other day. Oral temperatures and pulse rates were taken periodically as indices of thermal stress. Environmental data included analysis of CO_2 and O_2 concentration of the shelter air, air temperatures, relative humidities, wet-bulb-globe temperature indices, and wind velocities. The usefulness of the shelter appears to be limited in hot weather due to an interference with the loss of body heat from the men. (Author)

Bureau of Yards and Docks, Washington, D. C.
SEWERAGE SYSTEMS. 1 May 54, 133p. Technical pub. NAVDOCKS TP-PW-15; BUDOCKSINST 11345.2.
Order from LC mi$6.90, ph$21.30 PB 145 542

This publication provides guidance to Bureau and field personnel concerned with the planning, design, construction, maintenance, and operation of sewerage systems and appurtenant facilities for the collection, transportation, treatment, and disposal of sewage at naval shore activities. Part A delineates the general authority under which the Bureau of Yards and Docks is delegated administrative and operational responsibilities for sewerage systems. It also presents the policies, standards, and responsibilities of this Bureau in performing its mission, as well as operational policies and procedures and a list of definitions and abbreviations. Part B deals with design and construction criteria for sewerage systems and includes an analysis of sewage quantity and characteristics, collection systems, pumping facilities, treatment and disposal methods and equipment, and safety measures. Part C covers maintenance and operation procedures for collection systems, pumping facilities, and treatment and disposal systems. Emphasis is placed on gas-handling and backflow-prevention devices, personnel safety measures, stream pollution supervision and laboratory test procedures. Appendix A contains a report on the hazards of production and use of sludge gas. Appendix B contains further information on the responsibilities of the District Public Works Officer for sanitation control. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
NUCLEAR RADIATION SHIELDING PROVIDED BY BURIED SHELTERS, by J. C. LeDoux. Interim rept. 27 Oct 59, 76p. 17 refs. Technical rept. 025.
Order from LC mi$4.50, ph$12.30 PB 145 155

This report presents methods of calculating the attenuation of initial gamma, initial neutron, and residual gamma radiation incident upon buried shelters from fission-type weapons. Attenuation curves are presented which account for variation in the moisture content and density of the soil cover. The effect of the various energy spectra for each type of radiation has been considered. Three types of shelter configurations have been investigated: the rectangular or slab, the hemisphere, and the arch. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
PROTOTYPE 250-POUNDS-PER-HOUR ADVANCED BASE INCINERATOR, by K. B. Edwards and E. C. Morales. Final rept. 2 Dec 59, 27p. 4 refs. Technical rept. 053.
Order from LC mi$2.70, ph$4.80 PB 145 159

A prototype, 250-pounds-per-hour incinerator was developed for garbage-and waste-burning at Advanced Bases. It is rugged, portable, easily erected, and designed to be manufactured as a factory prefabricated kit including bagged powdered refractory for monolithic casting in the field. To determine the adequacy of the design, a kit was purchased, erected, and tested. This report gives the results of erection and performance tests of the prototype incinerator. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
PERFORMANCE SPECIFICATIONS FOR A SOUND NATIONAL SHELTER SYSTEM, by W. E. Strope. 13 Feb 57, 27p. 5 refs. Research and Development Technical rept. USNRDL-TR-132; AD-207 928.
Order from LC mi$2.70, ph$4.80 PB 144 696

The urgent need for a national shelter program because of the advance of megaton nuclear weapons and guided missile delivery systems is pointed out. Conclusions, based on five years of military atomic defense studies are presented regarding shelter performance specifications and estimated cost for a sound and feasible national shelter program. Utilizing three classes of shelter, the program is designed to provide adequate protection to the nation's population against the effects of fallout radiation, air blast, heat, and fire resulting from land-surface detonations of megaton weapons. Basic criteria used for establishing the shelter classes are ranges of weapon effects, building density, and population density. The classes of shelter are: Class I – fallout, 10-psi air blast; Class II fallout, 10-psi air blast, mass fires; Class IIIa fallout, 25-psi air blast, mass fires; and Class IIIb–fallout, 100-psi air blast,

mass fires. The interior arrangement and equipment of a typical shelter are illustrated. Estimated shelter construction costs per person range from about $30 to about $300 depending on shelter class, resulting in an estimated total construction cost for the national shelter system of about $15 to 20 billion. Additional costs for the total program would include those for development and engineering, land acquisition, and shelter equipment; but it is explained how these costs could be minimized. Feasibility of the program is discussed, together with modified programs that would take advantage of using existing construction and of integrating shelter construction into other construction programs. (Author)

New York U. Coll. of Engineering, N. Y.
THERMAL ENERGY EXCHANGE WITH SPECIFIC APPLICATION TO WASTE HANDLING IN A CLOSED ECOLOGICAL SYSTEM, by Lawrence Slote. Progress rept. on The Engineering Biotechnology of Handling Wastes Resulting from a Closed Ecological System, Contract AF 18(603)71. July 57, 8p. 5 refs. AFOSR-TN-58-268; AD-154 169.
Order from LC mi$1.80, ph$1.80 PB 137 795

The analysis attempts to show the variation in the total surface temperature of a perfect heat conducting or spinning biosatellite for a given orbit and for various conditions of irradiation. As the thermal capacity of the satellite is reduced a temperature distribution is obtained about the surface of the sphere. Therefore, it becomes evident that various temperatures can be obtained depending upon the geometry, surface and trajectory of the biosatellite. With this in mind, it seems feasible to use thermal energy sources in connection with processes for cracking of human waste and for the purification of urine by freezing, if these processes are used.

Ship Building

Bureau of Yards and Docks, Washington, D. C.
MOORING GUIDE. VOLUME 1. 1 Mar 54, 342p. 13 refs. Technical Pub. NAVDOCKS TP-Pw-2
Order from LC mi$11.10, ph$53.10 PB 145 540

This publication provides guidance to Bureau and field personnel concerned with determining the most practicable method of mooring vessels at a given site, either singly or in groups, and with effecting the planning, design, assembly, placement, inspection, repair, and maintenance of the Navy's permanent or temporary mooring facilities. Part A presents this Bureau's authority, policy, and responsibilities for providing the Navy's mooring facilities and defines related terms. Part B describes the various types of mooring devices and related equipment, including mooring buoys and anchors. Part C provides information on the design of mooring of various types. Part D covers the operation and care of all types of Fleet moorings, including inspection and maintenance of camels, fender piles, and dolphins, also the placement and recovery of moorings.

Bureau of Yards and Docks, Washington, D. C.
MOORING GUIDE. VOLUME 2. DRAWINGS. 12 Feb 57, supersedes 1 May 54, 68p. 3 refs. Technical Pub. NAVDOCKS TP-Pw-2; BUDOCKSINST 11153.2A, supersedes BUDOCKSINST 11153.2.
Order from LC mi$3.90, ph$10.80 PB 145 541

See PB 145 540

David Taylor Model Basin, Washington, D. C.
A CONTROL-SURFACE FLUTTER STUDY IN THE FIELD OF NAVAL ARCHITECTURE, by R. T. McGoldrick and D. A. Jewell. Sep 59, 47p. 25 refs. Rept. 1222; AD-226 588.
Order from LC mi$3.30, ph$7.80 PB 144 856

This study of control-surface flutter was initiated because of serious hull vibration on destroyers of the DD 931 Class. The source of the vibration had been traced to the twin rudders by the Boston Naval Shipyard. For making experimental observations on control-surface flutter phenomena in the towing basin, the David Taylor Model Basin constructed the TMB Control-Surface Flutter Apparatus. With this equipment, a marked decrease in overall damping was demonstrated when the downstream mass unbalance was increased during underway tests. A condition in which hydrofoil oscillatory motion results in low damping without oscillatory instability is defined as "subcritical flutter." Such a condition, which greatly magnifies the sensitivity of the mechanical system to external sources of vibration, may be quite significant in the field of naval architecture. Analyses varying in complexity are explored and compared with experimental results. (Author)

Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.
PRELIMINARY EVALUATION OF A SEMI-SUBMERGED SHIP FOR HIGH-SPEED OPERATION IN ROUGH SEAS, by Edward V. Lewis and Clayton Odenbrett. Rept. on Contract Nonr-263(10). Mar 59, 21p. 6 refs. Rept. no. 736.
Order from LC mi$2.70, ph$4.80 PB 144 647

This report describes the evaluation by means of model tests of an unusual hull form intended for high-speed operation in rough seas. The form can be described as a surfaced submarine, made longer and more slender in order to attain high calm-water speed A long natural pitching period is obtained by fine, hollow waterline endings and use of large peak ballast tanks for rough water operation. It was considered best not to attempt to keep water off the deck, and therefore comparatively low freeboard and tumblehome were adopted. Tests in regular head seas of model length and twice model length confirmed the expectation that at high speeds the semi-submerged ship could exceed the speeds at which the peaks of synchronous pitching and heaving motions occur. Consequently, in irregular head seas corresponding to a storm of Beaufort force 6, motions decreased as speed increased. Heaving was more pronounced than pitching, but accelerations were not prohibitively high

even at a speed of 40 knots. It is concluded that a semi-submerged ship of the type tested shows promise of attaining much higher rough-water speeds than conventional destroyers, provided sufficient power can be installed.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ARCTIC SURVIVAL RATIONS. III: THE EVALUATION OF PEMMICAN UNDER WINTER FIELD CONDITIONS, by Horace F. Drury, David A. Vaughan, and John P. Hannon. Jan 59, 37p. 24 refs. Technical rept. 58-6.
Order from LC mi$3.00, ph$6.30 PB 144 832

Pemmican, a dehydrated high-fat, high-protein, carbohydrate-free meat preparation was fed, with and without an isocaloric supplement of sugar, to 10 human subjects undergoing simulated survival in a severely cold environment for 9 days. No ill effects were noted that could not be attributed to caloric restriction, and the performance of the subjects was considered adequate for survival situations involving moderate activity. An isocaloric supplement of 40 grams of sugar increased the fasting blood-sugar levels, decreased the nitrogen balance, and decreased the excretion of ketones. During the 3 days following initiation of the dietary regimen, fasting blood-sugar levels and daily nitrogen balances fell precipitately, while ketone excretion rose. After this, however, the blood-sugar levels rose somewhat and leveled off, the nitrogen balance increased appreciably, and excretion of ketones fell gradually to quite low levels irrespective of the isocaloric supplement of sugar. These results have been interpreted to mean that the subjects were becoming adapted to the combination of pemmican and restricted caloric intake. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
ARCTIC SURVIVAL RATIONS. VII: ALTERATIONS IN SERUM ELECTROLYTES DURING WINTER FIELD TESTS OF SURVIVAL RATIONS, by John P. Hannon, Anna F. Larson and others. Sep 59, 11p. 8 refs. Technical rept. 58-25.
Order from LC mi$2.40, ph$3.30 PB 144 842

The levels of plasma sodium, potassium, calcium, magnesium, chloride, and phosphate, as well as blood hemoglobin and packed cell volume, were determined before and during simulated arctic winter survival. During the 5-day semi-starvation survival situation the following blood changes were noted: (a) an increase in magnesium and a decrease in calcium after the first day with subsequent return toward normal levels over the next 3 or 4 days; (b) a progressive decline in plasma phosphate during the first 4 days; (c) slight decreases in sodium, chloride, hemoglobin, and packed cell volume; (d) no significant change in plasma potassium. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
THE DISTRIBUTION IN ALASKA OF PLANT AND ANIMAL LIFE AVAILABLE FOR SURVIVAL, by John L. Buckley and Wilbur L. Libby (U. of Alaska). May 59, 47p. 8 refs. Technical rept. 58-10; AD-220 762.
Order from LC mi$3.30, ph$7.80 PB 144 846

This project was undertaken to determine the abundance of native foods, both plant and animal, available for survival in the Alaskan subarctic. In general, forest types produce the greatest amounts of edible materials; however, no single type is as productive as the ecotone between types. The supply of wild foods available fluctuates seasonally and between years. In good years, especially during late summer, native foods would probably be sufficient to prevent starvation in a well-trained individual. In poor years the chances of finding adequate foods would be greatly reduced. Recommendations for equipment for procuring native foods are given. (Author)

Army Medical Research and Nutrition Lab., Denver, Colo.
THE EFFECT OF HIGH TEMPERATURE STORAGE ON THE ACCEPTABILITY, DIGESTIBILITY AND COMPOSITION OF THE U.S. ARMY RATION, INDIVIDUAL, COMBAT, by Irvin C. Plough, Richard S. Harding and others. Final rept. on Metabolism and Nutrition. 22 Oct 58, 45p. 34 refs. Rept. no. 228.
Order from LC mi$3.30, ph$7.80 PB 138 597

Two groups of C rations, both from the same procurement in 1954, were obtained from the Quartermaster Food and Container Institute. One group had been stored at 100°F., and the other at 34°F., for 20 months. Analysis showed that storage had caused no changes in nutrient composition, except for considerable losses of thiamine and of vitamin B_6. These changes were more marked in the rations stored at high temperature. These two rations were fed to nine test subjects in comparison with a diet of approximately the same composition made up of fresh foods. The C rations, particularly those stored at hign temperature, evoked a number of mild symptoms, but these were doubtless of psychological origin. The protein and carbohydrate of the C ration were less digestible than were the nutrients in the fresh ration. High temperature storage further reduced the digestibility. The C ration stored at high temperature produced evidence of vitamin B_6 deficiency manifested by increased net excretion of xanthurenic acid, in response to a tryptophane load.

Quartermaster Food and Container Inst. for the Armed Forces, Chicago, Ill.
INVESTIGATION OF THE USE OF MONOSODIUM GLUTAMATE IN COMMERCIAL PRODUCTION OF PRECOOKED MEALS, by Mary B. Brown. Interim rept. no. 2, Dec 57, 6p. QMFCI rept. no. 42-57; AD-154 839.
Order from LC mi$1.80, ph$1.80 PB 144 880

This study reports the results of sensory evaluations of eight different precooked frozen meals and two casseroles prepared with and without monosodium glutamate after storage at -20° F., 0° F., and at fluctuating temperatures. Monosodium glutamate improved the acceptance of all food items with the exception of the chicken items and tenderloin steak with mushroom sauce. The lack of improvement in acceptance of these two items may be attributed to the high concentration of MSG used. (Author)

Quartermaster Food and Container Inst. for the Armed Forces, Chicago, Ill.
THE STABILITY OF VITAMIN-FORTIFIED DEHYDRATED SOUPS, by Mariam H. Thomas. Interim rept. on Simplified Food Logistics. Aug 58, 19p. 7 refs. QMFCI rept. no. 21-58.
Order from LC mi$2.40, ph$3.30 PB 144 881

Dehydrated cream of onion and cream of potato soups fortified with thiamine, ascorbic acid, and vitamin A palmitate have been evaluated after storage. Samples were packed in rigid and flexible containers for storage at 70° and 100°F. Analyses for palatability and vitamin content were made initially and after storage for six, twelve, and twenty-four months. There was evidence of flavor deterioration during storage. However, there was no significant difference in palatability ratings for fortified and unfortified samples throughout storage. Samples stored in cans were preferred to those stored in packages. In general, better vitamin retention was obtained in dehydrated soup which was canned and stored at 70°F.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Engines and Propulsion Systems

Aerophysics Development Corp., Santa Barbara, Calif.
NON-STATIONARY COMBUSTION STUDIES, by D. Bitondo and D. Perper. Rept. on Contract AF 18(600)1509. Aug 58, 51p. 11 refs. Aerophysics TR 58-98; AFOSR-TR-58-144; AD-204 734.
Order from LC mi$3.60, ph$9.30 PB 137 951

A study of gaseous fuel ignition in transient flow by means of a "heated wall" mounted in the test section of a shock tube is the subject of this report. The process was followed photographically by means of schlieren apparatus and a high speed Fastax movie camera. Pressure in the test section and in the immediate vicinity was followed by means of high frequency pressure recorders.

Douglas Aircraft Co., Inc., El Segundo, Calif.
INVESTIGATION OF THE EFFECTIVENESS OF A WINDMILL ON IMPROVING FLOW UNIFORMITY IN A DUCT, by J. S. Murphy and D. W. Clutter. Rept. on Contract NOa(s) 54-321. 8 Oct 57, 103p. 4 refs. Rept. no. ES-26393; AD-161 446.
Order from LC mi$5.70, ph$16.80 PB 145 206

Tests have been made to determine the effectiveness of a freely rotating windmill in smoothing out nonuniform duct flow. The action of the windmill is to transfer total head from high-speed regions to low-speed regions. The design of a windmill and the forces on a windmill due to changes in wind speed are discussed. The experimental results show the effect of blade angle and number of blades on the windmill's effectiveness in smoothing out a wide variety of disturbance profiles, both circumferential and radial.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
ELECTRON TEMPERATURE DEPENDENCE OF THE RECOMBINATION COEFFICIENT IN PURE HELIUM, by C. L. Chen, C. C. Leiby, and L. G. Goldstein. Scientific rept. no. 7 on Contract AF 19(604)2152. 1 Sep 59, 158p. 45 refs. AFCRC-TN-59-597.
Order from LC mi$7.50, ph$24.30 PB 144 961

Recombination of oppositely charged particles of a helium gas discharge plasma is studied in this work. Attention has been focused especially on investigating the law governing the variation with electron temperature of the recombination coefficient, characterizing the process of recombination of free electrons with positive ions in decaying plasmas produced in pure helium. A better treatment to the guided wave propagation in a waveguide filled with ionized gases has been given, which is believed to give more accurate determination of the fundamental parameters in a gaseous discharge plasma confined in the geometry used. In the determination of the electron temperature, correction due to thermal conduction has also been included in an approximate way.

Fairchild Guided Missiles Div., Fairchild Engine and Aircraft Corp., Wyandanch, N. Y.
FIBERGLASS CONTAINERS FOR J-57 ENGINE, by Harry E. Kellar (Materials Lab.) Rept. for June 56-May 58 on Finishes and Materials Preservation, Contract AF 01(608)832. Feb 59, 74p. 10 refs. WADC Technical rept. 58-268; AD-209 911.
Order from LC mi$4.50, ph$12.30 PB 144 991

Twenty fiberglass containers were manufactured for the Air Force to serve as shipping containers for the J-57 jet aircraft engine. The application of fiberglass for this purpose has proved successful with the exception of a liner sealing problem. The fiberglass container assembly weighs approximately 50% less than its metal counterpart, and testing has proved it to be rugged enough to withstand the rough handling it may receive in shipment. The container consists of two shells, upper and lower, with the basic construction utilizing plies of bidirectional roving fabric impregnated with polyester resin. The sealing liner is made of rigid vinyl, thermoplastically drawn under vacuum into the shells. Provisions have been incorporated for fork lift, cable hoisting, rollover

and stacking of the containers three high while in storage. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMODYNAMIC PROPERTIES AND CALCULATED ROCKET PERFORMANCE OF HYDROGEN AT 20,000°K, by David Altman. Rept. on Contract DA 04-495-ORD-18. 3 Sep 56, 32p. 12 refs. Rept. no. 20-106.
Order from LC mi$3.00, ph$6.30 PB 144 761

A tabulation is made of the equilibrium thermodynamic properties of hydrogen between 300 and 20,000°K. Consideration is given to molecular dissociation, atomic excitation, and ionization. The data are presented in Mollier charts, for the purpose of simplifying rocket performance calculations. Tables are presented which list the specific-impulse and power values required to develop a given thrust at a specified chamber temperature. A tabulation is also given of the loading factors required for escape from the earth by a hydrogen missile operating at various temperatures. (Author)

Koppers Co., Inc. [Pittsburgh, Pa.]
EVALUATION OF DESIGNS AND MATERIALS FOR HIGH SPEED-HIGH TEMPERATURE SHAFT SEALS FOR TURBOJET ENGINE APPLICATIONS, by John J. Brenza, John H. Fuchsluger and others. Rept. on Gas Turbine Technology, Contract AF 33(616)5015. 31 Dec 58, 110p. 5 refs. WADC-Technical rept. 56-267, Pt. 2; AD-219 109.
Order from OTS $2.50 PB 151 915

The demand for higher performance aircraft engines has resulted in increase in engine operating temperatures and pressures. In turn, this has necessitated the adoption of new shaft seal materials and refinement in shaft seal design. This development program was undertaken to develop rubbing seals that would operate for 1000 hours, at 1000°F, and at a rubbing speed of 30,000 feet per minute. Accordingly new materials were investigated; these materials were incorporated in seals; and their performance as seals was evaluated. In all, one hundred and sixty-three materials were screened on the basis of room temperature and 1000°F, dry, rubbing, wear tests and 1000-hour, 1000°F oxidation tests. Material combinations found to be promising were next evaluated as seals under increased operating conditions, and eventually under conditions duplicating those existing in a jet engine. (Author) (See also PB 121 992)

Massachusetts Inst. of Tech. [Cambridge].
OPTIMIZATION OF SPACE VEHICLE DESIGN WITH RESPECT TO PROPULSION SYSTEM, by Paul E. Sandorff. Rept. on Contract AF 49(638)363. 1 July 58, 11p. 6 refs. AFOSR-TN-58-580; AD-158 402.
Order from LC mi$2.40, ph$3.30 PB 137 861

A mathematical analysis was made of propulsion systems necessary to move a desired useful payload to a given destination in as feasible and as efficient a manner as possible. The specific impulse to the most significant factor is the performance of the propulsion system of contemporary chemical rockets. Optimum specific impulse was shown to depend on the particular duty for which the engine was designed. Typical characteristics for various types of reaction engines as they are currently conceived are presented.

Pennsylvania State U. Coll. of Engineering and Architecture, University Park.
THE FILM VAPORIZATION PRINCIPLE FOR GAS TURBINE COMBUSTORS, by Gunter W. Maybach. Final rept. on Contract Nonr-656(13). Mar 59, 46p. 9 refs.
Order from LC mi$3.30, ph$7.80 PB 145 212

A new combustion principle for gas turbine engines is developed that inherently reduces the formation of smoke and of carbon deposits inside combustion chambers, and should permit more compact combustor designs without increasing the pressure loss across the combustors. The new combustion principle is based on the vaporization of the fuel from a liquid film spread along the inner wall surface of a cylindrical combustor section. Several problems relating to the mixture formation and combustion mechanisms of the new principle were treated. A research prototype combustor incorporating the film vaporization principle was built and its operational characteristics determined. (See also PB 144 371)

Picatinny Arsenal, Dover, N. J.
SUITABILITY OF CARBON BLACK PRODUCED BY THE OIL FURNACE PROCESS FOR USE IN ROCKET PROPELLANTS, by J. S. Merten. Dec 58, 43p. 8 refs. Technical rept. DB-TR: 16-58.
Order from LC mi$3.30, ph$7.80 PB 138 357

Commercial furnace blacks adversely affect the stability of M7 propellants and therefore were not suitable for M7 propellant manufacture. The poor stabilities obtained with the M7 propellant using the furnace blacks cast doubt on the use of these blacks for the manufacture of M16, T16, and T19 compositions. Further study of furnace blacks is unwarranted because the very small mobilization requirements for carbon black should be readily available from commercial sources.

Plasmadyne Corp., Santa Ana, Calif.
EQUILIBRIUM THERMODYNAMIC PROPERTIES OF HELIUM TO 60,000°K, by Gordon L. Cann and Adriano C. Ducati. Technical note no. 4 on Contract AF 49(638)54. 18 June 59, 90p. 4 refs. P-4TN069-54; AFOSR-TN-59-633; AD-228 710.
Order from LC mi$4.80, ph$13.80 PB 144 864

Helium was considered as a possible propellant for a plasma propulsion system because of its low molecular weight. To obtain reasonable exhaust velocities (greater than 10,000 m/sec.) it is necessary to heat the gas to temperatures at which an appreciable percent ionization occurs. In order to assess the potentially available exhaust velocities when ionization is

present, it is necessary to have a Mollier chart to determine isentropic expansions, hence the thermodynamic properties of helium were computed over a temperature range of 6000-60,000°K and a pressure range of 10^{-4} -10^{-2} atm. A Mollier chart was constructed from this data. (Author)

Plasmadyne Corp., Santa Ana, Calif.
RESEARCH ON HIGH INTENSITY IONIC JETS, by Gordon L. Cann and Adriano C. Ducati. Final technical rept. on Contract AF 49(638)54. 5 Nov 59, 30p. 7 refs. P-FR109-54; AFOSR-[TR]-59-167.
Order from LC mi$2.70, ph$4.80 PB 144 907

The various steps that have been completed in the development of a practical plasma jet propulsion unit are outlined and detailed references to the work made. The steps that still need to be completed before a prototype unit can be constructed are indicated. (Author)

Space Research Labs., Litton Industries, Beverly Hills, Calif.
RESEARCH STUDY ON PLASMA ACCELERATION, by G. Fonda-Bonardi. Final rept. for 1 Mar 58-30 Sep 59 on Contract AF 49(638)345. 30 Sep 59, 76p. 207 refs. AFOSR-TR-59-170.
Order from LC mi$4.50, ph$12.30 PB 144 906

This report contains a summary of the principles of operation, design criteria, construction details and instrumentation of a pulsed plasma accelerator. The purpose of the project was twofold: to provide verification of the theory previously developed, and to supply engineering information and design data for further applications of the principles involved. A bibliography on pertinent magnetohydrodynamics research and related subjects is appended.

Manufacturing Equipment and Processes

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
RAPID LOADING OF ALUMINUM ALLOY RIVETED JOINTS, by Robert T. Ault. Rept. for Nov 58-June 59 on Materials Analysis and Evaluation Techniques. Dec 59, 23p. 3 refs. WADC Technical rept. 59-433.
Order from OTS $0.75 PB 161 434

Slow and rapid loading tensile shear tests were conducted at room temperature to determine the failure strength of multiple riveted lap and butt joints. Both concentric and eccentric loading conditions were used. The time to failure for the rapid loading tests ranged from 0.02 to 0.08 seconds. All failures were by rivet shear. The results indicate that for both eccentric and concentric loading conditions, rapid loading has no significant effect on the strength of the joint. (Author)

Metcut Research Associates, Cincinnati, Ohio.
MACHINING CHARACTERISTICS OF HIGH STRENGTH THERMAL RESISTANT MATERIALS, by Leonard J. Nowikowski. Interim Engineering rept. no. 6, Phase II, 1 Apr-10 July 59, on Contract AF 33(600)35967. 14 Aug 59, 424p. Wright Aeronautical Serial rept. no. MP. 00-192; AD-220 540.
Order from OTS $6.00 PB 161 369

A study of the machining characteristics in turning, milling, drilling, and tapping on twenty-five high strength, thermal resistant alloys. The data is presented in graphical form to show the relationships between tool life, cutting speed, feed, tool geometry, tool material and cutting fluids. Cutting and thrust force measurements, average power requirements, coefficient of friction for the turning operation and thrust force and torque measurements were made for drilling. The data for these tests is shown in graphical form to show the torque and thrust requirements for drilling these materials for various machine conditions. The average power required for drilling these materials was computed. Grinding characteristics for six alloys show the effect of wheel speed, table speed, cross feed, down feed, wheel grade, and grinding fluid on wheel wear and surface finish. Grinding and face milling tests on three materials show workpiece distortion and residual stress as a function of machine variables. (See also PB 140 798)

Metcut Research Associates, Inc., Cincinnati, Ohio.
MACHINING CHARACTERISTICS OF HIGH STRENGTH THERMAL RESISTANT MATERIALS. PHASE III. MACHINE TOOL REQUIREMENTS, by Leonard J. Nowikowski. Rept. for 2 Sep-18 Dec 59 on Subcontract to Contract AF 33(600)35967. 18 Dec 59, 55p. Wright Aeronautical serial rept. no. MP. 00-204.
Order from LC mi$3.60, ph$9.30 PB 145 016

Machine tool requirements were established for machining the high strength thermal resistant alloys. The required range of speeds, feeds and power in turning, milling, drilling, tapping and grinding are listed in tables for each alloy group. Several recent developments in machine tools designed specifically for machining the high strength thermal resistant alloys are also described.

Southern Research Inst., Birmingham, Ala.
AN INVESTIGATION OF ELECTROPOLISHING AS A TECHNIQUE FOR PRODUCING TAPERED WIRE, Technical note no. 1, 1 May-15 Sep 59, on Contract AF 08(635)391. Nov 59, 35p. 6 refs. APGC-TN-59-59.
Order from LC mi$3.00, ph$6.30 PB 144 573

Tests were run on carbon steel music wire and Type 302 stainless steel wire to determine what loss in unit strength would result from electropolishing 0.050- and 0.033-inch diameter wire down to 0.020 inch. The purpose was to discover whether electropolishing might be a feasible method of manufacturing a continuously tapered tow cable for aerial targets. The stainless steel increased in unit strength from 276,000 psi at 0.0495-inch diameter to 374,000 psi at 0.023-inch diameter. The carbon steel music wire unit strength remained substantially constant. It was concluded that electropolishing is a technically feasible technique, and it was recommended that design

parameters be determined for a production setup to produce a tapered tow wire. (Author)

Transport, Traction and Hoist Facilities

American Machine and Foundry Co., Chicago, Ill.
DYNAMIC MODES OF TRANSPORTATION STUDY. Addendum to Final rept. on Contract AF 30(635)2903. 14 Feb 57, 3p. RADC-TR-57-16B AD-114 500.
Order from LC mi$1.80, ph$1.80 PB 137 568

This addendum to the Final Report on the "Dynamic Modes of Transportation Study" contains further suggestions regarding techniques of programming a platform-type shaker; such a machine had been proposed for the simulation of the shock and vibration environments to which military electronic equipment is subjected in field transit.

Bureau of Yards and Docks, Washington, D. C.
MOVING AND RIGGING HANDBOOK. Engineered Performance Standards, Public Works Maintenance. Oct 59, 97p. NAVDOCKS P-709.
Order from LC mi$5.40, ph$15.30 PB 145 002

The Engineered Performance Standards set forth time values which cover most of the work performed by the Moving and Rigging Craft. Spread Sheets are task times grouped by subject area and time. The time to perform a specific task is obtained by using the group value time covering equal work content described on the spread sheet. Task Times are derived from operation time values. Task times include all operations constituting the task but not job preparation time, travel time, or allowances for delays. Operation Times are the formula values taken from the formula manual. They represent the actual time required to perform a portion of a task and, when several are added together, they become the time to perform the task. The task areas included in this manual are: crane operations, equipment moving, reeving, shop operations, and weight capacity testing.

Bureau of Yards and Docks, Washington, D. C.
MOVING AND RIGGING FORMULAS. Engineered Performance Standards, Public Works Maintenance. Oct 59, 101p. NAVDOCKS P-709.1.
Order from LC mi$5.70, ph$16.80 PB 145 006

Contents:
Heavy equipment travel
Crane operation
Sling operations
Reeving
Hand rigging
Lashing
Winch operations
Shop operations
Weight capacity testing of motor-truck cranes

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
THE EFFECT OF MOLTEN BISMUTH ON INSULATING MATERIALS, by W. S. Fleshman and C. G. Collins. 9 Feb 50, 16p. NEPA-1306-SCR-56; AD-206 722.
Order from LC mi$2.40, ph$3.30 PB 138 453

Samples of twenty-six Johns-Manville insulating materials, which included cements, bonded fibrous blocks and fire bricks, were tested for possible reaction with molten bismuth. The tests consisted essentially of pouring molten bismuth at 1832°F (1000°C) over insulation maintained both at room temperature and at 1832°F (1000°C), although some tests were made in which the insulation was heated together with the bismuth for periods up to three hours. In general, the results indicated that little or no reaction, particularly of an explosive nature, occurred when the molten bismuth came into contact with the unheated materials, and that none of the materials would withstand contact with the bismuth when both were at 1832°F (1000°C) for more than a few hours. Greatest resistance to bismuth attack was shown by three types of asbestos millboards.

Virginia Agricultural Experiment Station, Blacksburg.
COMBINED INTRA- AND INTER-BLOCK ANALYSIS FOR FACTORIALS IN INCOMPLETE BLOCK DESIGNS, by R. E. Walpole, R. A. Bradley and C. Y. Kramer. Technical rept. no. 2 on The Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). Mar 58, 145p. 26 refs. AD-157 825.
Order from LC mi$7.20, ph$22.80 PB 138 572

A combined intra- and inter-block analysis was obtained for factorials in balanced incomplete block designs, group divisible designs, and Latin Square type of partially balanced, incomplete block designs. For the class of Latin Square sub-type L_3 designs, both the intra-block and combined intra- and inter-block analyses were considered. Estimators for the factorial effects were obtained along with their variances and covariances. Sums of squares in terms of the factorial estimators were derived which can be used for tests of significance. These sums were independently distributed as x^2-variates with the appropriate number of degrees of freedom. For the special cases of 4 x 4 Latin Square sub-type L_3 designs, a complete analysis yielding the adjusted sums of squares, for the factorial effects, was possible. The appropriate sums of squares for main effects and interactions of a multi-factor factorial were obtained either as functions of the original estimators or as functions of the row and column averages of the original treatment estimators. The method of incorporating a fractional replicate of a factorial was also considered. Numerical examples were worked in detail for a group divisible design and a Latin Square sub-type L_3 design. The problem of analyzing factorials in various types of lattice designs is being investigated.

Armour Research Foundation, Chicago, Ill.
RESEARCH AND DEVELOPMENT SERVICES LEADING TO THE CONTROL OF ELECTRICAL PROPERTIES OF MATERIALS FOR HIGH TEMPERATURE RADOMES, by Leon M. Atlas. Rept. for 1 July 58-30 Apr 59 on Electrical and Electronic Materials, Contract AF 33(616)5929. Oct 59, 34p. 14 refs. WADC Technical rept. 59 300.
Order from OTS $1.00 PB 161 423

Methods are described for the preparation of high purity aluminum oxide (less than 100 ppm of impurities) by the solution of 99.999% Al metal in hydrochloric acid and precipitation with ammonia. After calcining at 1400°C, this batch was fabricated into ceramics by firing in air at temperatures up to 1900°C. Loss tangents at 500°C approach that of sapphire, and the temperature variation of dielectric constant is considerably lower than for high purity commercial aluminas. Defects in alumina ceramics produced by impurities and by interactions with gaseous atmospheres have been studied by measuring the reflectance and thermoluminescence of gamma irradiated specimens.

Cincinnati U., Ohio.
THE SYSTEM TITANIUM-ZIRCONIUM-OXYGEN, by Michael Hoch, Robert L. Dean and others. Rept. for 1 Nov 56-31 Aug 59 on Solid State Research and Properties of Matter, Contract AF 33(616)3881. July 59, 83p. 37 refs. WADC Technical rept. 59-539.
Order from OTS $2.25 PB 161 435

The general shape of the 1450°C isotherm of the Ti-TiO-ZrO_2-Zr region was calculated from the surrounding binary phase diagrams. The phase boundaries were accurately determined by investigating 50 compositions using X-ray and metallographic techniques. The isotherm at 1500°C for the region TiO-TiO_2-ZrO_2 was obtained by investigating 45 compositions, using X-ray diffraction. The activities of titanium and TiO in the α + TiO + tetragonal ZrO_2 and the two $\alpha + \beta$ + tetragonal ZrO_2 regions were measured using the Knudsen effusion method. The solidus and liquidus surfaces were determined by observing samples suspended with a fine tungsten wire in a tungsten crucible, and heated in vacuum. The oxidation of titanium-zirconium alloys was also investigated. The presence of zirconium in titanium, and vice versa, decreases the oxidation resistance and the alloys oxidize faster than the pure metals.

Douglas Aircraft Co., Inc., Long Beach, Calif.
INFLUENCE OF SURFACE ON CERAMIC MECHANICAL PROPERTIES, by George R. Pulliam. Rept. for June 58-June 59 on Solid State Research and Properties of Matter, Contract AF 33(616)5875. Sep 59, 36p. 13 refs. WADC Technical rept. 59-261.
Order from OTS $1.00 PB 161 309

This study was devoted to establishing the importance of gaseous and liquid environments, electromagnetic irradiation, and non-stoichiometry on the deformation and fracture processes in ceramic materials. The surface condition of the material and its chemical environment have been found to have a large effect on these processes. The small ductility of magnesium oxide is reduced by air and basic solutions. Acid solutions produce ductility in previously brittle magnesium oxide. Exclusion of air by a protective coating or a protective atmosphere preserves the ductility. Photochemical reactions essentially stop the creep of silver chloride. A more quantitative evaluation of these effects should be conducted to permit the establishment of the mechanisms operating. (Author)

Minerals Research Lab., U. of Calif., Berkeley.
INTERNAL STRESSES IN MODEL CERAMIC SYSTEMS II. A. X-RAY STRAIN MEASUREMENT TECHNIQUES FOR CERAMIC BODIES. B. EXTENDING THE RANGE OF REPLICATION TECHNIQUES, by Leonard N. Grossman, Richard M. Fulrath and Robert B. Langston. Technical progress rept. no. 2 on Contract AF 49(638)04. 1 Oct 59, 36p. 14 refs. Series no. 119, issue no. 2; AFOSR-TN-59-1181.
Order from LC mi$3.00, ph$6.30 PB 145 018

X-ray diffractometer techniques for measuring triaxial and biaxial strain in ceramic bodies are described. Results using Al_2O_3 and ThO_2 crystal phases with various glasses in the Na_2O-B_2O_3-SiO_2 system are presented. It is shown that internal stresses due to expansion coefficient mismatches occur in these systems and that their magnitudes often exceed the bulk strength of the body. A progress report is included on obtaining the microstructures of model ceramic systems used in the investigation of internal stresses in ceramics.

Ohio State U. Research Foundation, Columbus.
EXPLORATORY STUDY OF NICKEL-MAGNESIA CERMETS, by Earle T. Montgomery and Paul E. Rempes, Jr. Rept. on Contract AF 33(616)3. Apr 53, 11p. 1 ref. WADC Technical rept. 53-164; AD-14 010.
Order from LC mi$2.40, ph$3.30 PB 145 333

Test bars were prepared by combining finely ground commercially fused MgO with 38.8 and 71.6 wt-% of Ni at high pressures and sintering. Descriptions are presented of the body preparation, sintering, and testing procedures. Results indicated that: (1) the firing shrinkage and the oxidation resistance increased with the longer milling time, (2) the porosity of most of the bars was under 1.0%, (3) modulus-of-rupture strength at room temperature was fair, and (4) thermal shock resistance of the specimens was adequate. It was concluded that combinations of Ni and MgO for use as solid body cermets are less promising than other oxide-base cermets now available.

Utah U., Salt Lake City.
CERAMIC STUDIES SUMMARY TECHNICAL REPORT, by P. Gibbs, G. S. Baker and others. Rept. for June 58-Apr 59 on Ceramic and Cermet Materials, Contract AF 33(616)5876. Aug 59, 20p. 9 refs. WADC Technical rept. 59-381.
Order from OTS $0.50 PB 161 146

Progress is reviewed in the preparation of high purity and doped sintered alumina samples. A high-precision fast-recording, bending creep furnace with resolution of at least 10^{-6} strain in the outer fiber is described. Preliminary tests suggest a stick-slip behavior with jumps of about 5.10^{-5} strain in the outer fiber. Progress in an electrical study of corundum-metal interface is reviewed. Migration of silver ions from a coating is found above 200° C on application of several volts/cm. The observed conduction current rises to an asymptotic value of nearly an amp. in seconds. The rise time for this process depends upon the temperature as well as the length of time during which the specimen "rested" without any field. The value of the asymptotic current was greatest at about 350° C. (Author)

Fuels, Lubricants, and Hydraulic Fluids

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE APPLICABILITY OF LINEAR VISCOELASTIC ANALYSIS TO ROCKET GRAIN DESIGN, by E. H. Lee. Technical rept. no. 3 on Contract NOrd-17838. July 58, 24p. 7 refs. AD-200 172.
Order from LC mi$2.70, ph$4.80 PB 145 216

The significance for the stress analysis problem of rate effect in materials in the form of delayed elasticity and creep is discussed, and the present well developed methods of attack on the problem through the theory of linear viscoelasticity are mentioned. It is shown that a method of testing the applicability of this theory to a specific design problem for a specific material is available for which any convenient component containing the material can be used with a free choice of loading pattern. This eliminates the need for carefully made test specimens and uniform loading systems in assessing the influence of viscoelasticity and linearity. Such a test for a propellant grain is suggested. Once the applicability of the theory has been established, the need for carefully designed experiments to measure basic viscoelastic properties is emphasized. The accurate determination of shear and compressibility properties is essential for the understanding of the behavior under combined stresses, which characterizes most propellant grain design problems. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT AND APPRAISAL OF A PHOTOGRAPHIC TECHNIQUE FOR ROCKER-MOTOR-COMBUSTION STUDY, by George A. Agoston. Rept. on Contract NOa(s)-53729. 29 Jan 54, declassified. 22p. 5 refs. Rept. no. 25-1.
Order from LC mi$2.70, ph$4.80 PB 145 615

The application and merits of Lucite, fused silica, and Pyrex in transparent-motor construction is described. High-speed, colored-motion-picture photography of RFNA-ammonia flame within transparent motors has been investigated for use in combustion research. This photographic technique has proved to be useful in general flow visualization. Because of flame opacity no success was achieved in utilizing it in tracer tracking for local velocity determination. Evidence has been obtained which suggests that the bright-yellow luminosity emitted from a thin rectangular motor with Lucite flame panels originates from burning Lucite rather than from propellant constituents or reaction components. In tests with cylindrical motors the shift in luminosity from one side of the turbulence ring to the other was demonstrated when the position of the latter was changed with respect to the injector. The disappearance of diffuse luminosity at a distance from the injector in a long transparent motor was noted under acid-rich conditions. Local gas analysis and temperature measurement in the nonluminous, annular, recirculating gas zone surrounding the flaming jet issuing from a turbulence ring indicated lack of attainment of equilibrium. (Author)

Massachusetts Inst. of Tech., Cambridge.
METHODS OF TESTING MECHANICAL PROPERTIES OF PROPELLANTS, by Albert G. H. Dietz, Frederick J. McGarry, and James Dorsey. Final summary rept. for 1 Mar 50-31 May 54 on Contract DA 19-020-ORD-6. [1954] 121p. 7 refs.
Order from LC mi$6.30, ph$19.80 PB 144 990

The purpose of this research was to develop and explore various methods of testing the mechanical properties of solid rocket propellant materials. A high speed tensile testing device which provides stress-strain information from tests of a few milliseconds duration has been designed, constructed and operated. Using data and techniques from an extensive static testing program on plasticized polymethyl methacrylate, a considerable amount of mathematical analysis work has been done. The purpose of this was to present conveniently and predict accurately the stress-strain-time relations describing viscoelastic behavior. A high frequency sonic, through transmission, device was designed and built to investigate one type of nondestructive test procedure for propellant materials. Operating in the 1/2-5 megacycle region at very low energy levels, it makes possible the determination of the velocity of transmission and apparent energy absorption characteristics of propellant materials.

Midwest Research Inst., Kansas City, Mo.
MODIFICATION OF SHELL FOUR-BALL WEAR TESTER FOR 800°F OPERATION AND DEVELOPMENT OF A LUBRICANT EVALUATION TECHNIQUE, by Vernice Hopkins. Rept. for Apr 57-Dec 58 on Aviation Lubricants, Contract AF 33(616)5205. June 59, 68p. 4 refs. WADC Technical rept. 59-48; AD-215 447.
Order from LC mi$3.90, ph$10.80 PB 145 451

The modifications made to adapt the Shell four-ball wear tester for 800°F operation have been outlined. Detailed discussions of the design changes, the frictional torque measuring setup, lubricant circulating system, and the application of additional controls and instrumentation are presented. The evaluation of the performance of the modified wear tester is described. Operating test procedures for a conventional test and the alterations required for lubricants solid at room temperature and for lubricants circulating through the ballpot assembly are included. Testing experiences

are discussed, especially for high temperature tests. A method for evaluating lubricants is outlined. (Author)

Naval Research Lab., Washington, D. C.
IGNITION OF HYDROCARBON VAPORS BY CONTINUOUS DC ARCS, by F. J. Woods, K. G. Williams, and H. W. Carhart. Interim rept. 30 Dec 59, 18p. 12 refs. NRL rept. 5423.
Order from OTS $0.50 PB 161 068

Studies of the ignition of flammable vapors by dc arcs drawn between stationary metal-plate electrodes and retracting spherical electrodes have shown that quenching effects of the electrodes play a dominant role in the ignition process. This dominance decreases as the spherical electrodes are made smaller and as the rate of separation is increased. With electrodes which are separated at rates less than the propagation velocity of the incipient flame kernel in the direction of electrode movement, the arc must be extended to a distance comparable to the quenching distance of the electrode system for spark ignitions. This quenching distance can be determined experimentally and expressed in terms of dimensional parameters for given electrode geometries. The electrical requirements for maintaining arcs to the required separation were found to depend on the material of the electrodes and the electrical characteristics of the current supply. (Author)

Naval Research Lab., Washington, D. C.
SHIPBOARD STUDIES OF FUEL-VAPOR IGNITION BY RADIO-FREQUENCY ARCS, by F. J. Woods, K. G. Williams and H. W. Carhart. Interim rept. 25 Jan 60, 16p. 3 refs. NRL rept. 5443.
Order from LC mi$2.40, ph$3.30 PB 143 950

Shipboard studies of radio frequency arcs developed on parked aircraft aboard the CVA 42 have shown that arcs of 0.4 ampere or more drawn from locations with an open-circuit potential greater than 120 volts can ignite flammable concentrations of fuel vapor. Such arcs were observed under conditions which were considered normal for purposes of fueling. Measurements of arc voltage and current are reported for various locations of the aircraft and transmitters. Suggestions are made for reducing the possibility of accidental fires. (Author)

Naval [Weapons Plant] Washington, D. C.
INVESTIGATION OF FLUIDS FOR USE IN HYDRAULIC TYPE RECOIL AND RECOIL-COUNTER-RECOIL MECHANISMS, AND IN HYDRAULIC TYPE BUFFERS, by M. R. Dyer. 12 Dec 58, 108p. 8 refs. Technical rept. no. NGF-T-20-57; NAVORD rept. 511; AD-209 272.
Order from LC mi$5.70, ph$16.80 PB 144 675

Experience in service revealed that some fluids currently used in hydraulic type recoil and recoil-counterrecoil mechanisms and in hydraulic type buffers have unsatisfactory low temperature properties and that corrosion occurs within this equipment. An investigation was therefore conducted on twenty different fluids, ten different packings, and three different metals to evaluate the compatibility of these materials for use in this equipment. The fluids were of four classes: (1) Glycerin-water Mixtures, (2) Petroleum Base Oils, (3) Hydrolubes, and (4) Water-Soluble Ucon Fluid. Included among these fluids were several currently used in Naval Ordnance. The packings were of three classes: (1) Rubber, (2) Leather, and (3) Flax. The metals used were Carbon Steel, Alloy Steel, and Phosphor Bronze.

Naval [Weapons Plant] Washington, D. C.
USE OF COLLOIDAL GRAPHITE (IN POLYALKYLENE GLYCOL) AS AN ALL-WEATHER LUBRICANT ON THE 3"/50 CAL. GUN SURFACES, SUCH AS, BARRELS, COUNTER-RECOIL-SPRING GUIDES AND HOUSING GUIDES; TEST AND EVALUATION OF, by Robert C. Duncan. 19 Sep 56, 17p. Technical rept. no. NGF-T-29-56; NAVORD rept. no. 5178.
Order from LC mi$2.40, ph$3.30 PB 138 344

Tests indicate that the counter recoil time of the 3"50 gun is less while using colloidal graphite (in Polyalkylene Glycol) than while the currently recommended cold weather lubricant mixture is used.

Ordnance Fuels and Lubricants Research Lab., Southwest Research Inst., San Antonio, Tex.
CONTINUED DEVELOPMENT OF CRC L-38 TECHNIQUE, by William P. Teich. Rept. on Contract DA 23-072-ORD-1144. Sep 58, 88p. 4 refs. AD-211 625.
Order from LC mi$4.80, ph$13.80 PB 138 266

A series of sixteen tests were conducted to investigate the effect on oil oxidation and bearing weight loss of the following: (1) an increase in the oil gallery temperature, (2) a higher engine speed and consequently a higher connecting rod bearing rubbing velocity, and (3) a reduced lubricating oil output from the engine driven oil pump. The results of these tests indicated that a slight increase in bearing weight loss occurs as the result of an increase in the oil gallery temperature, an increase in engine speed within the limits of these tests will not significantly alter the bearing weight loss, and the oil pump output between the limits of 1.81 gal/min and 3.0 gal/min has no significant effect upon test severity. With the knowledge that it is urgent that a CLR engine procedure be available as soon as possible to replace the current CRC L-4 procedure, it is recommended that studies be undertaken to eliminate the excessive camshaft thrust washer wear, determine the effects of introducing various amounts of air into the crankcase, and determine the desirability of using the new type low volume external oil heater. (Author)

Rock Island Arsenal Lab., Ill.
MILLIPORE FILTER TECHNIQUE FOR ANALYSIS OF CONTAMINATION IN MISSILE HYDRAULIC FLUID, by H. S. Muffley. 30 June 59, 17p. 1 ref. Rept. no. 59-1773.
Order from LC mi$2.40, ph$3.30 PB 145 113

The servo valves found in the guidance system of missiles are extremely sensitive to solid particle

contamination extending to particles of microscopic size. Forty-one samples of missile hydraulic fluids including new, used, and reprocessed oils, were filtered through a millipore filter. Four areas of the millipore filter were photographed at 100X. The size range and distribution of the solid particles were established for the areas photographed. Total counts for the entire filtering area were then calculated. The millipore filter technique provides a fairly reliable estimate of the level of contamination of a missile fluid, however, the validity of the results is dependent upon the control of the many variables encountered. (Author)

Southwest Research Inst., San Antonio, Tex.
AIRCRAFT GEAR LUBRICATION. A LITERATURE SURVEY, by A. Hundere and B. B. Baber, Jr. Rept. on Contract AF 33(616)498. Oct 53, 100p. 206 refs. AD-20 156.
Order from LC mi$5.40, ph$15.30 PB 145 691

A summary is presented of the information that was developed from a literature survey on gear lubrication applicable for aviation use. The published information on the effect of lubricant factors, design features, and operating variables on gear tooth scuffing and pitting is summarized. Available information on test techniques and test methods is included. The articles pertinent to aircraft gear lubrication and gear lubricants are listed chronologically with abstracts in the appendix.

Thiokol Chemical Corp., Trenton, N. J.
A STUDY OF THE CORROSIVE EFFECTS OF THE COMBUSTION PRODUCTS OF BORON CONTAINING FUELS ON SELECTED HIGH TEMPERATURE MATERIALS, by Frank J. Loprest and Steven J. Tunkel. Rept. for July 56-May 58 on Aviation Fuels, Contract AF 33(616)3713. Sep 59, 331p. 21 refs. WADC Technical rept. 57-542.
Order from OTS $5.00 PB 161 421

A method is presented for treating in a quantitative manner the corrosion data obtained, as is a rating of all the alloys tested. The data show that for all alloys there exists a critical temperature (Tc) in the range 1600 to 2000°F above which the corrosion rate increases very rapidly with increasing temperature, and above which serious pitting, and even destruction, occurs within 150 hours. The rate of corrosion below Tc has been determined. A characteristic value, A, representing this rate has been listed for many alloys and tentatively related to the elemental composition. The effect of velocity of combustion products on the corrosion process has been discussed. Mechanisms of the process are presented. Finally, data on the cleaning of deposited boric oxide by saturated steam are included. (Author)

Leather and Textiles

Little, Arthur D., Inc., Cambridge, Mass.
CANDIDATE MATERIALS FOR HIGH TEMPERATURE FABRICS. Rept. for July 58-Feb 59 on Air Force Textile Materials, Contract AF 33(616)5880. Sep 59, 166p. 49 refs. WADC Technical rept. 59-155.
Order from OTS $3.00 PB 161 411

This program involved an evaluation of existing data relative to the development and use of high-temperature fabrics for re-entry parachutes. Anticipated environmental and aerodynamic factors of re-entry from satellite orbits were used as a basis for the selection of candidate materials. Among these factors were heating and deceleration rates, surface temperatures, erosion and corrosion rates, strength-to-weight properties at elevated temperatures, porosity, and flexibility. All evaluated, including metals, ceramics glasses, inorganic and organic polymers, and single crystal systems (whiskers). Although there was very little data on the behavior of fine filaments at the expected environmental conditions, we were able to select commercially available materials that could be used in a high-temperature parachute cloth with a minimum of development work. We also defined the type of data necessary to the development of more sophisticated fabrics that would have greater reliability and an extended service temperature. (Author)

Material Lab., New York Naval Shipyard, Brooklyn.
EVALUATION OF NON-DESTRUCTIVE TEST METHODS FOR LAMINATED FIBER GLASS PLASTIC MATERIALS, by J. A. Reilly and M. Goldberg. Final rept. 8 Sep 59, 19p. 5 refs. Lab. Project 5761-1.
Order from LC mi$2.40, ph$3.30 PB 144 928

Due to the increasing use of glass laminated plastic products, simple and rapid non-destructive test methods are required to determine the presence of internal structural defects such as voids, resin-rich areas, and delaminations. Several methods, based on the development of visually observable flaw patterns as a result of variations in thermal conductivity through the item tested, were evaluated. A method based on the use of thermo-sensitive decals in conjunction with an infrared heat source was selected as potentially suitable, within defined limits.

Photographic Materials

Technical Operations, Inc., Burlington, Mass.
CHEMISTRY OF PHOTOGRAPHIC DEVELOPMENT, by James E. LuValle and Gershon M. Goldberg. Final rept. on Contract AF 18(600)371. 31 Aug 58, 34p. 21 refs. TOI 58-30; AFOSR-TR-58-112; AD-201 772.
Order from LC mi$3.00, ph$6.30 PB 138 214

The over-all aims and accomplishments have been briefly discussed with reference to the pertinent technical notes. Recommendations have been given as to the areas in which further work appears to be necessary. Abstracts of all technical notes released by this project or by related projects which grew out of it

have been given in the Appendix. This report covers 6 years of contract work and encompasses numerous findings in the field.

Plastics

Army Prosthetics Research Lab., Washington, D. C.
REVISED CALIBRATION CURVE FOR DETERMINATION OF STAIN RESISTANCE OF VINYL MATERIALS, by James T. Hill and William Wiedmann. 3 Feb 59, 3p. 2 refs. Technical rept. no. 5903; AD-211 236.
Order from LC mi$1.80, ph$1.80 PB 144 725

In previous work calibration curves were presented for use in determining stain resistance of vinyl materials using a color difference meter. These curves were obtained using two tiles for standards. A blue tile was used with the stained samples and a white tile for the unstained samples. To simplify this procedure we decided to calibrate the color difference meter using one tile which would result in a single calibration curve. This report discusses this investigation.

Hughes Aircraft Co., Culver City, Calif.
RESEARCH ON HIGH TEMPERATURE POLYMERS, by J. B. Rust, C. L. Segal and H. H. Takimoto. Technical rept. no. 2, 1 Sep 58-1 Mar 59 on Contract Nonr-2540(00). [1959] 53p. 55 refs. AD-217 196
Order from LC mi$3.60, ph$9.30 PB 144 891

A study was made of the synthesis of polymer intermediates of the type $[(CH_3)_3SiO]_n$ $Ti(OC_3H_7)_{4-n}$, where n was 2 or 4. A chemical analysis and an IR spectra analysis were conducted on the products. The postulated structure of the Ti ester intermediates was verified. The reaction of ethyl orthosilicate with trimethylacetoxysilane to form intermediates analogous to the Ti esters produced low yields of the Si ester when sodium ethylate catalyst was used. A linear polymer, a poly(triorganosiloxy)titanosiloxane, with a weight average molecular weight of 42, 300 was obtained by the use of sodium ethylate as a catalyst. Some indication was given that part of the trimethylsiloxy side groups were cleaved during the reaction or during processing of the polymers. Poly(triorganosiloxy)titanoxanes were prepared and the products were identified; there was some indication of cleavage of trimethylsiloxy groups. Polymers containing Si and Al, poly(triorganosiloxy)aluminoxanes were prepared. A linear polymer was found to have a weight average molecular weight of 42, 500. (See also PB 140 992)

Material Lab., New York Naval Shipyard, Brooklyn.
METHODS FOR DETERMINING THE SHEAR MODULUS OF GLASS REINFORCED PLASTIC LAMINATES, by P. M. Goldfarb. Final rept. 31 Aug 59, 21p. 8 refs. Lab. Project 5995-1.
Order from LC mi$2.70, ph$4.80 PB 145 037

Tests were conducted on a 1/4 inch style 181 glass cloth reinforced polyester laminate employing spans of 1 in. to 5 in. length. The beam bending method is more rapid and requires a much smaller specimen than the panel shear method.

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
INVESTIGATION OF THREE FIBER-RESIN DEPOSITORS PHASE II, by M. E. Phelps and L. N. Schultz. June 59, 60p. 4 refs. Rept. no. P-399-2.
Order from LC mi$3.60, ph$9.30 PB 144 742

Three fiber-resin depositors were obtained for comparison and evaluation. Molded items and laminates to determine physical strengths were prepared. Each depositor was evaluated with regard to various operational features. Areas of usefulness of the depositors to the Navy were considered somewhat limited. (Author)

Midwest Research Inst., Kansas City, Mo.
FABRICATION AND DEVELOPMENT OF COMPOSITE PLASTIC PLATES, by Howard W. Christie and Daniel A. Netzel. Quarterly progress rept. no. 3, phase II [Final], 16 Jan-15 Apr 59, on Contract NOas 58-563-c. 5 June 59, 62p. 3 refs.
Order from LC mi$3.90, ph$10.80 PB 144 890

Short cure cycles for the polymerization of diethylene glycol bis(allyl carbonate) have been achieved. The allyl resins do not appear promising for production of temperature resistant composites. Fabrication of allyl composites proved to be extremely difficult. Cracking of the allyl layer occurred during polymerization. High internal stresses developed by shrinkage of the resin during cure and the low strength of the partially cured resin produced the failure. Upon exposure to elevated temperatures the composites failed with cracking of the allyl layer. Epoxide resins have proved promising for the temperature resistant layer of the composites. The low shrinkage of the epoxide resins upon polymerization greatly reduces internal stressing. A curved composite of an anhydride cured epoxy resin has been fabricated. The color stability of the epoxide resins at temperatures above 300°F is poor. Most of the discoloration is produced by oxidation of the exposed surface. (See also PB 139 584)

Naval Ordnance Test Station, China Lake, Calif.
PRELIMINARY INVESTIGATION OF THE RELATIVE EFFECTS OF VARIOUS CURING FACTORS ON THE COMPRESSIVE STRENGTH OF AN ASBESTOS-FILLED MOLDED PHENOLIC RESIN, by J. S. Simpson and H. B. Porter. 12 Dec 58, 19p. NOTS TP-2149; NAVORD rept. 6441; AD-211 000.
Order from LC mi$2.40, ph$3.30 PB 144 869

A preliminary series of tests was conducted on a molded asbestos-filled phenolic resin to determine the relative effects of several curing factors on the compressive strength of the fully-cured resin. A secondary objective was to determine the feasibility of substituting gamma radiation for heat in the post cure stage.

Physical Sciences Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
THE EFFECTS OF IONIZING RADIATION UPON TRANSPARENT MATERIALS, by Gregory Arutunian and Fred L. Seppi. 26 Oct 59, 38p. (4 color photographs will not reproduce) Rept. no. RR-1.
Order from LC mi$3.00, ph$6.30 PB 145 013

Commercial-grade glass, polystyrene, plexiglas, allyl carbonate, and polyvinyl acetate were exposed to x-rays ranging in energy from 50 KVP to 150 KVP for differing lengths of time. As a result of radiation, materials containing doubly bound oxygen atoms exhibited the greatest coloration and exhibited a greater loss in transmittance in the blue region of the visible spectrum than in the red. Polystyrene, an oxygen-free aromatic hydrocarbon, was least affected by x-rays and, on the basis of retention of optical transmission, can be considered for vehicular optical viewing systems exposed to intense gamma-radiation or x-rays.

Rubber and Elastomers

Institute of Rubber Research, U. of Akron, Ohio.
STRESS RELAXATION AND THE STRUCTURE OF HIGH TEMPERATURE ELASTOMERS, by Maurice Morton, V. R. Allen, and R. D. Gates. Technical rept. no. 3, 1 Dec 58-28 Feb 59, on Contract Nonr-2573(00). [1959] 28p. 7 refs.
Order from LC mi$2.70, ph$4.80 PB 144 960

A theoretical study has been made of the effect of a "recombination" (crosslinking) reaction on the relation between sol formation and network breakdown during degradation in bulk or in a swollen condition. Experimental work on sulfur vulcanizates of natural rubber has actually shown that the sol vs. degradation relations for the above two cases are very divergent. From a similar investigation of peroxide vulcanizates of natural rubber, it was found that there is no apparent "recombination" during swollen degradation. (See also PB 143 458)

International Latex Corp., Dover, Del.
DEVELOPMENT OF ELASTOMERS WITH IMPROVED PROPERTIES IN THE ABSENCE OF CARBON BLACK REINFORCEMENT, by Verle A. Miller, Edwin B. Gienger, Jr. and others. Comprehensive progress rept. no. 3, 1 July 55-31 Jan 56, on Contract DA 44-109-qm-1778. [1956] 81p. AD-92 245.
Order from LC mi$4.80, ph$13.80 PB 145 440

Under an earlier contract the development of butadiene/acrylonitrile/methacrylic acid terpolymers was described. Dipped films of these terpolymers exhibited gum tensile strengths as high as 4000-6000 psi. combined with high oil resistance equivalent to that of the low strength Buna N rubbers. This contract covers two work phases: I. Compounding and evaluation studies with the above terpolymers directed toward applying these advances to mill compounded stocks. II. The preparation and evaluation of other functional group-containing polymers directed toward an attempt to improve the strength and tear resistance of unreinforced synthetic rubbers by utilization of reversible secondary bonding forces or chemical reaction between various polar groups of the polymer chains. (See also PB 142 062)

Wood and Paper

Marine Lab., U. of Miami, Coral Gables, Fla.
MARINE BORER INVESTIGATIONS. Annual rept. for Jan-Dec 57 on Contract NOy-81879. Feb 58, 37p. 9 refs. Rept. 58-1; AD-158 567.
Order from LC mi$3.00, ph$6.30 PB 137 904

The ultimate objective of the program is to develop an efficient, dependable wood preservative treatment for protection of wood against attack by marine borers. Wood which has been pressure-impregnated with coal tar creosote exhibits adequate resistance to marine borer attack in temperate regions. In some tropical and sub-tropical coastal areas however, creosoted piling and timber is relatively short-lived, presumably because the higher water temperature accelerates leaching of the preservative, and because some forms of boring organisms peculiar to these regions are relatively resistant to the toxic action of creosote, even when it is present in the wood in maximum concentrations. Inasmuch as creosote has been shown to be an effective marine wood preservative for many applications, one channel of the research program has been directed toward improvement of the preservative ability of creosote by systematic modification of its constitution. However, because the complex composition of creosote might limit the degree of success which can be attained by such an approach, an equal effort has been devoted to development of preservatives unrelated to creosote. Results of the overall preservative development program may be categorized as follows: (1) Accelerated evaluation of modified creosotes. (2) Modification of the accelerated leaching-exposure test. (3) Investigation of the mechanism of creosote diffusion within wood. (4) Screening of experimental preservative materials. (5) Studies on copper-based preservative treatments.

Material Lab., New York Naval Shipyard, Brooklyn.
INVESTIGATION OF THE STANDARD ASTM MECHANICAL AND PHYSICAL PROPERTIES OF EKKI, Lophira procera, A. CHEV. IN THE GREEN AND AIR DRY CONDITION OF MOISTURE, by C. P. Cologer. Progress rept. no. 5 (Final) on Lab. Proj. 5740-7. 17 June 59, 26p. 18 refs. AD-226 708.
Order from LC mi$2.70, ph$4.80 PB 144 677

The standard ASTM mechanical and physical properties of ekki, Lophira procera, in the green and air-dry moisture conditions were investigated. Test indicated that ekki is generally below greenheart in its mechanical strength, although it is similar to greenheart in specific gravity. Ekki is equivalent to greenheart in side hardness, shear parallel to grain, cleavage and superior in end hardness. The mechanical properties of ekki are superior to white oak, and

are in accord with the difference in their relative specific gravities. The order of merit for the mechanical strength of the 3 species is greenheart, ekki, and white oak. The volumetric shrinkage of ekki compares favorably with greenheart. Ekki appeared to have a greater tendency to warp on seasoning than greenheart. The computed weights per cubic foot at 50% moisture content disclosed that ekki and greenheart would have approximately the same weight, and that both would be significantly heavier than white oak.

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
MARINE LAMINATING PROPERTIES OF SELECTED WOOD SPECIES, ANGELIQUE (DICORYNIA GUIANENSIS) by R. F. England. Aug 59, 5p. 7 refs. Progress rept. no. E-412-3.
Order from LC mi$1.80, ph$1.80 PB 145 111

The laminating properties of angelique (a tropical South American hardwood) were investigated using three commercial adhesives. Curing conditions of 150-153°F for 6 hours (glueline temperature) produced satisfactory results with each of the adhesives tested. (Author)

MATHEMATICS

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ARITHMETIZATION OF METAMATHEMATICS IN A GENERAL SETTING, by Solomon Feferman. Technical rept. no. 1 on Contract DA 04-200-ORD-997. 25 Aug 59, 112p. 33 refs. OOR rept. 2379.1-M.
Order from LC mi$6.00, ph$18.30 PB 145 073

The method of arithmetization, as developed by Gödel (Monatshefte f. Math. u. Physik, v. 38 (1931) p. 173-198), exploits the possibility of defining within a formal theory $\mathcal{T}$, or in arithmetical theories closely related to $\mathcal{T}$, various syntactical and logical notions concerning $\mathcal{T}$. In broad terms, the applications of the method can be classified as being extensional if essentially only numerically correct definitions are needed, or intensional if the definitions must more fully express the notions involved, so that various of the general properties of these notions can be formally derived.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
SOME STOCHASTIC PROCESSES WITH APPLICATIONS TO COUNTER MODELS, by Ronald Pyke. Technical rept. no. 44 on Contract N6onr-25140. 18 Dec 58, 38p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 144 939

A family of stochastic processes with applications in physics as well as in economic risk-theory is described. Following the work of Takacs [Acta. Math. Ac. Sci. Hung., vol. 5 (1954) pp. 203-236] the one-dimensional characteristic functions of the processes, as well as their covariance functions, are determined. The notions of counts, state A, and state B, are defined. In two special cases the expected number of counts and the expected time in state A are studied in more detail. In one case, a system of partial differential equations is given for a quantity which can be used to determine both the probability of being in state A and the expected number of counts. In a second case, approximations to the expected number of counts may be obtained by the method of steepest descents. Examples are given. (Author)

California U., Berkeley.
THE CLOSED GRAPH THEOREM AND THE KREIN-SMULIAN THEOREM, by J. L. Kelley. Technical rept. no. 20 on Contract Nonr-222(37). Jan 58, 28p. 6 refs. AD-153 817.
Order from LC mi$2.70, ph$4.80 PB 137 913

The purpose of the investigation reported here was to describe the class of locally convex Hausdorff spaces F for which a closed graph theorem holds for all possible spaces E (a more precise statement is given later). It will be shown that such spaces F are precisely those which satisfy a weakened form of the requirement that the class $\mathcal{C}$ of all convex circled subsets of F be complete relative to the Hausdorff uniformity. We will call F hyper-complete if $\mathcal{C}$ is complete; a complete metric space is automatically hyper-complete.

California U., Berkeley.
THE PARTITION FUNCTION FOR CERTAIN SIMPLE LIE ALGEBRAS, by Jan Tarski. Technical rept. no. 7 on Contract AF 49(638)79. Aug 58, 21p. 3 refs. AFOSR-TN-58-657; AD-162 188.
Order from LC mi$2.70, ph$4.80 PB 137 580

Explicit expressions are found for the partition function for the following Lie algebras: A_2, B_2, G_2, and A_3.

Carnegie Inst. of Tech., Pittsburgh, Pa.
AXIALLY SYMMETRIC SOLUTIONS OF ELLIPTIC DIFFERENTIAL EQUATIONS, by Richard C. MacCamy and Albert E. Heins. Technical rept. no. 24 on Contract AF 49(638)227. Nov 58, 37p. 15 refs. AFOSR-TN-58-922; AD-204 558.
Order from LC mi$3.00, ph$6.30 PB 137 775

An investigation is made of the representation of solutions of the axially-symmetric elliptic equations. The representations are derived by exploiting the connection between such equations and singular initial value problems for hyperbolic equations. The result is a correspondence between solutions of the elliptic equations and functions of a complex variable. Certain boundary-value problems for the elliptic equations are solved explicitly or semi-explicitly with the aid of these representations. (Author)

Chicago U., Ill.
GROUP EXTENSIONS BY PRIMARY ABELIAN GROUPS, by Saunders Mac Lane. Rept. on Contract

AF 18(600)1383. May 59, 27p. 7 refs. AFOSR-TN-59-457; AD-215 262.
Order from LC mi$2.70, ph$4.80 PB 144 935

The effective calculation of the functor Ext(A, G) is considered which is defined as the group of all Abelian group extensions of the Abelian group G by the Abelian group A. For finitely generated A, the functor is known: (1) it is additive in A, (2) Ext(Z, G) = 0 when A = Z is the infinite cyclic group and (3) for A the finite cyclic group Z/mZ of order m, Ext(Z/mZ, G) = G/mG. The case when A is a torsion group is considered. The assumption is made that A is a p-primary group T, i.e., a group in which every element has order a power of the prine p. (Author)

Chicago U., Ill.
NON-UNIQUENESS IN CAUCHY'S PROBLEM, by A. Plis. Technical note no. 5 on Research on the Hilbert Transform and Related Topics, Contract AF 49(638)451. Aug 59, 10p. 3 refs. AFOSR-TN-59-1034.
Order from LC mi$1.80, ph$1.80 PB 145 070

Colorado U., Boulder.
SEQUENCES GENERATED BY ITERATION, by W. J. Thron. Rept. on Contract AF 49(638)100. [1958] 20p. 3 refs. AFOSR-TN-59-938; AD-226 018.
Order from LC mi$2.40, ph$3.30 PB 145 442

The rapidity of convergence is investigated for sequences generated by functions of the class H and of certain subclasses. The difference is considered between sequences generated by different functions and sequences generated by the same function with different initial elements. This results in obtaining, for sufficiently restricted g, all terms that are not affected by the value of the initial element of the sequence.

Colorado U., Boulder.
A TWO-PARAMETER FAMILY OF BEST TWIN CONVERGENCE REGIONS FOR CONTINUED FRACTIONS, by L. J. Lange and W. J. Thron. Rept. on Contract AF 49(638)100. [1959] 35p. 8 refs. AFOSR-TN-59-1301.
Order from LC mi$3.00, ph$6.30 PB 144 777

In this paper we shall study the continued fraction

$$1 + \frac{a_1}{1} + \frac{a_2}{1} + \cdots$$

whose elements a_n satisfy the conditions

$$a_{2n-1} = c_{2n-1}^2, \quad |c_{2n-1} \pm ia| \geq \rho$$

$$a_{2n} = c_{2n}^2, \quad |c_{2n} \pm i(1+a)| \geq \rho$$

where a is a complex number and a and ρ satisfy the inequality $|a| < \rho < |1 + a|$.

Columbia U., School of Engineering, New York.
TABOO GENERATING FUNCTIONS AND OTHER TOPICS IN MARKOV CHAINS, by Peter Frank. Technical rept. no. 2 (N) on Contract Nonr-266(55). 26 Feb 59, 73p. 11 refs. AD-211 635.
Order from LC mi$4.50, ph$12.30 PB 144 810

Combinatorial properties and limit properties of Markov chains are studied. The assumption is made that the Markov chain is always one with discrete time, a countable number of states, and stationary transition probabilities. A complete answer is given to the problem of expressing the function $_Tp_{ij}(z)$ (the generating function of the probability $_Tp_{ij}^{(n)}$) in terms of the functions of the class $p_{kl}(z)$ when the taboo set of states T is finite. The limit condition is considered for $\lim_{z \to 1} {}_ip_{ii}(z) = 2$, which expresses the fact that the state i is recurrent. The notion of alternation of a Markov chain and the notion of a subchain are considered. If weights $[W_i]$ with $W_i > 0$ are given, the problem is considered for finding whether an indecomposable recurrent Markov chain exists which has these numbers as stationary weights. Two uniform theorems are established which state that a property is true of all states if it is true for one state.

Columbia U., New York.
MULTIVARIATE DISTRIBUTIONS WITH GIVEN MARGINS, by E. J. Gumbel. Technical rept. T-12A on Contract DA 30-069-ORD-1061. 1 July 58, 54p. 6 refs. CU-12-58-ORD-1061-IE; OOR rept. 1716.6; AD-200 607.
Order from LC mi$3.60, ph$9.30 PB 144 804

We have developed a general system of multivariate distributions for given marginal distributions under the assumption that the marginal distributions possess at least two moments, and, that the multivariate probability function has at least two derivatives. This system includes a new bivariate normal distribution, where the regression curves are not linear and the curves of equal probability are not ellipses. It was believed that the correlation always varies between ±1. However within the general system the coefficient of correlation varies only from -1/3 to +1/3. The two limits are reached for the bivariate uniform distribution. For a certain bivariate exponential distribution the correlation has only one fixed value. The usual properties of the coefficient of correlation hold for the bivariate normal distribution for which it was designed. But they do not hold for the general case of multivariate distribution. Assume we know that the marginal distributions are normal and obtain a correlation r = .30 based on a large number of observations. The usual conclusion that the correlation is weak is based on the unwarranted hypothesis that the bivariate distribution is of the Bravais-Pearson type. If the bivariate distribution belongs to the system developed here, the correlation is about 95 per cent of a possible maximum, i.e., very high. (Author)

Cornell U., Ithaca, N. Y.
GENERALIZATIONS OF A THEOREM OF WALD ON MONOTONE SEQUENCES, by Ralph Agnew Palmer. Rept. no. 54 on Contract AF 18(600)685. Aug 56, 19p. 1 ref. AFOSR-TN-56-355; AD-95 441.
Order from LC mi$2.40, ph$3.30 PB 137 678

Duke U., Durham, N. C.
AN APPROXIMATE SOLUTION TO AN IMPROPER BOUNDARY VALUE PROBLEM, by Jim Douglas, Jr. and T. M. Gallie, Jr. Rept. on Contract AF 18(600)1341. Aug 58, 17p. 14 refs. AFOSR-TN-58-776; AD-201 924.
Order from LC mi$2.40, ph$3.30 PB 138 174

Hadamard called those boundary value problems whose solutions do not depend continuously on the boundary data "improperly posed." In this paper we give a new solution of an improperly posed problem first solved by Kreisel (Proc. of the Royal Society A, vol. 195 (1959) p. 160-183), His method of solution is to seek smoothed solutions of an integral equation; our method is to seek a normal family of solutions of the corresponding differential equation.

Harvard U., Cambridge, Mass.
THE BILINEAR RELATION ON OPEN RIEMANN SURFACES, by Robert D. M. Accola. Rept. on Contract AF 18(600)1461. Oct 59, 37p. 9 refs. AFOSR-TN-59-951.
Order from LC mi$3.00, ph$6.30 PB 144 871

Harvard U., Cambridge, Mass.
SOLUTION OF THE DIRICHLET PROBLEM FOR THE ELLIPSE BY INTERPOLATING HARMONIC POLYNOMIALS, by J. L. Walsh. Rept. on Contract AF 18(600)1461. Oct 58, 7p. 5 refs. AFOSR-TN-58-1001; AD-206 144.
Order from LC mi$1.80, ph$1.80 PB 137 779

Recently J. H. Curtis has raised anew the question of interpolation by harmonic polynomials, and points out the analogy to interpolation by polynomials in the complex variable. He conjectures that satisfactory points of interpolation may be (for instance) equally spaced on the boundary of D with respect to the conjugate of Green's function for the complement of D. The object of the present note is to confirm this conjecture for the case that D is the interior of an ellipse, by computation of the polynomials involved.

Hebrew U. (Israel).
LOCAL DIFFERENTIAL ALGEBRA, by Abraham Robinson. Technical note no. 4 on Contract AF 61(052)187. May 59, 62p. 4 refs. AFOSR-TN-59-817; AD-220 589.
Order from LC mi$3.90, ph$10.80 PB 145 311

A consistency condition is obtained for a system of algebraic differential equations with given initial values. Theories are developed for ideals, polynomial ideals, and corresponding varieties. The starting point is a differential ring whose elements, at a given point, are represented by a homomorphic mapping into an ordinary ring.

Institute for Advanced Study, Princeton, N. J.
DIFFERENCE METHODS FOR PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS, by Milton Lees. Rept. on Contract AF 49(638)253. Sep 59, 28p. 16 refs. AFOSR-[TN]-59-1039.
Order from LC mi$2.70, ph$4.80 PB 145 304

The purpose of this paper is to introduce and apply a general technique for analyzing stability and convergence of the principal difference schemes currently in use for approximating solutions of parabolic differential equations. In addition to linear parabolic equations with non-constant coefficients, the method will be applied to certain non-linear equations.

Institute for Advanced Study, Princeton, N. J.
INTEGRATION OF THE GOURSAT PROBLEM BY DIFFERENCE METHODS, by Milton Lees. Rept. on Contract AF 49(638)253. Oct 59, 19p. 6 refs. AFOSR-TN-59-1109.
Order from LC mi$2.40, ph$3.30 PB 145 318

In this paper we employ finite difference methods to solve the Goursat problem for linear and quasi-linear hyperbolic equations in characteristic form. In addition to existence and uniqueness theorems, we derive several approximation theorems. The results are based on an integral inequality for the solutions of the Goursat problem which is similar to the well-known energy inequality for hyperbolic equations. (Author)

Institute for Advanced Study, Princeton, N. J.
ON UNIVALENT FUNCTIONS WITH REAL COEFFICIENTS, by James A. Jenkins. Rept. on Contract DA 36-034-ORD-2453. Dec 58, 20p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 138 578

The object of the present paper is to treat the class of univalent functions with real coefficients using the usual normalization in a unified manner through the medium of the General Coefficient Theorem [3;4, p. 51]. In this way we obtain substantially more complete results than have been obtained before. Among others we obtain the exact domain covered by the image of the unit circle under every such function, the region of values of such functions at a point in the unit circle and new bounds involving the derivative of these functions.

Institute for Advanced Study, Princeton, N. J.
UNIQUE CONTINUATION FOR PARABOLIC DIFFERENTIAL EQUATIONS AND INEQUALITIES, by M. Lees and M. H. Protter. Rept. on Contract AF 49(638)253 and National Science Foundation Grant G-5863. Oct 59, 22p. 8 refs. AFOSR-TN-59-1110.
Order from LC mi$2.70, ph$4.80 PB 145 317

In this paper certain unique continuation theorems are proved for parabolic equations and inequalities. Essentially, these continuation theorems have the following form. If a solution of a parabolic equation (or inequality) exists in a region and vanishes in a subregion, then it vanishes in the original region. As a consequence of one of the continuation theorems, the uniqueness of the first mixed, initial-boundary value problem for "negative time" is proved. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
A METHOD FOR EVALUATING CERTAIN LATTICE SUMS, by A. A. Maradudin and G. H. Weiss. Rept.

on Contracts AF 18(600)(1015 and 1315). Sep 58, 8p. 6 refs. Technical note BN-148; AFOSR-TN-58-927; AD-204 737.
Order from LC mi$1.80, ph$1.80 PB 137 776

A method for transforming slowly convergent lattice sums into very rapidly convergent sums with the aid of asymptotic expansions is presented, and the method is applied to the evaluation of a class of sums evaluation of a class of sums evaluated previously by Benson and Schreiber by purely numerical methods. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ON CERTAIN REFLECTION PRINCIPLES, by E. P. Miles, Jr. Rept. on Contract AF 49(638)81. July 58, 12p. 10 refs. Technical note BN-146; AFOSR-TN-58-702; AD-162 236.
Order from LC mi$2.40, ph$3.30 PB 137 506

A reflection principle was recently established by A. Huber (Communications on Pure and Applied Mathematics 9:471-478, 1956) for functions polyharmonic of order p, applicable when the function and its first p-1 derivatives with respect to x_1 vanish on the hyperplane of reflection $x_1 = 0$. Huber's theorem includes as special cases the classical principle of H. A. Schwarz for harmonic functions and the corresponding results of H. Poritsky (Trans. Am. Math. Soc. 59:248-279, 1946) and R. J. Duffin (Duke Math. J. 22:313-324, 1955) for biharmonics. Assuming that a polyharmonic function of order p, meeting the above conditions on its derivatives, has an analytic continuation across this hyperplane, a locally valid expansion for the function is obtained in terms of its Cauchy data on the hyperplane. From this expansion an alternate reflection principle of limited range is obtained which is shown to be reducible to the Schwarz, Duffin, and Huber principles for $p = 1, 2, 3$, respectively, within their common range of validity. Results for the iterated Laplace equation are used which closely parallel those recently discussed by the author. A brief description is also presented of a corresponding heuristic approach to the reflection principle for the Helmholtz equation treated recently by Diaz and Ludford [Annali di Mathematica Pura ed Applicata, Serie IV, Tomo XXXIX (1955) pp 87-95].

Institute of Mathematical Sciences, New York U., N. Y.
EXTENSIONS OF THE KHINCHINE-WISSER THEOREM, by Harold N. Shapiro. Rept. on Contract Nonr-285(38). Dec 58, 43p. IMM-NYU 253.
Order from LC mi$3.30, ph$7.80 PB 144 854

Wisser provided a much simplified proof of Khinchine's theorem, and at the same time dropped the assumption of stationarity. In this note various extensions of Wisser's result are obtained, which focus on providing subsequences, of given infinite sequences, on which the probability of any finite intersection is bounded from below in a "natural way".

Institute of Mathematical Sciences, New York U., N. Y.
A MULTIPLYING FACTOR METHOD FOR THE SOLUTION OF WIENER-HOPF INTEGRAL EQUATIONS, by B. Noble and A. S. Peters. Rept. on Contracts AF 19(604)5238 and Nonr-285(46). July 59, 7p. 1 ref. Research rept. no. EM-137; AFCRC-TN-59-391; AD-226 646.
Order from LC mi$1.80, ph$1.80 PB 145 066

Institute of Mathematical Sciences, New York U., N. Y.
NOTE ON THE CENTRAL LIMIT THEOREM, by Harold N. Shapiro. Rept. on Contract Nonr-285(38). Feb 59, 13p. IMM-NYU-254.
Order from LC mi$2.40, ph$3.30 PB 144 703

Institute of Statistics, U. of North Carolina, Chapel Hill.
STEP-DOWN PROCEDURE IN MULTIVARIATE ANALYSIS, by J. Roy. Rept. on Contract AF 18(600)83. Dec 57, 18p. 7 refs. Mimeograph series no. 187; AFOSR-TN-58-33; AD-148 072.
Order from LC mi$2.40, ph$3.30 PB 137 711

The step-down procedure is applied to the multivariate analysis of variance and the comparison of variance-covariance matrices in order to derive new tests of significance and simultaneous confidence-bounds on a number of deviation-parameters. The step-down procedure is not invariant under a permutation of the variates and should be used only when the variates can be arranged on a priori grounds. Some advantages of the step-down procedure are that (1) the procedure uses widely known statistics like the variance-ratio; (2) the test is carried out in successive stages and in significance is established at a certain stage, one can stop at that stage; (3) it leads to simultaneous confidence-bounds on certain meaningful parametric functions.

Laboratory of Statistical Research, U. of Washington, Seattle.
ON CONTINUITY OF TRANSITION FUNCTIONS, by R. M. Blumenthal. Technical rept. no. 29 on Contract Nonr-477(11). 21 Oct 57, 11p. 3 refs. AD-148 390.
Order from LC mi$2.40, ph$3.30 PB 137 713

The continuity of transition functions $P(T, x, A)$ of a time-homogeneous Markov process with state-space X is discussed from the standpoint of placing less restrictive properties on the function than was done by J. L. Doob (Stochastic Processes, New York, 1953) and D. G. Kendall (Trans. Amer. Math. Soc. 78:529-540, 1955) when they assumed that for each x in X, $P(t, x, [x]) \to 1$ as $t \to 0$. The following properties are always assumed: (1) for each $t > 0$ and x in X, $P(t, x, \cdot)$ is a measure on $\underline{F}$ with $P(t, x, X) \leq 1$; (2) for each $t > 0$ and A in F, $P(t, \cdot, A)$ is $\underline{F}$-measurable; and (3) for each $s > 0$, $t > 0$, x in X, A in $\underline{F}$, $P(t+s, x, A) = \int P(t, y, A)(s, x, dy)$. These additional properties are also assumed at various stages in the discussion: (1) for each A in F, $P(t, x, A)$ defines a function on $(0, \infty) \times X$ which is measurable in (t, x) with respect to

the product Borel field of the Lebesgue measurable subsets of $(0,\infty)$ and $\underline{F}$; and (2) with x fixed, for each A in $\underline{F}$, $\lim_{t\to 0} P(t, x, A)$ exists. F is a Borel filed of subsets of X.

Llosá, R. San Juan.
SEMI-ANALYTICAL FUNCTIONS IN CONVEX REGIONS. Rept. on Contract AF 61(514)1254. [1956] 363p. 65p. AFOSR-TR-59-60; AD-216 625.
Order from LC mi$11.10, ph$56.10 PB 145 097

Contents:
Introduction: Convex functions of a variable and convex plan sets: continuity of convex functions; derivations of converse functions
Chap. 1. Domains and fundamental functions: convex stars and circularly convex domains; the fundamental domains; the fundamental functions
Chap. 2. Fundamental sequences: convex rectified; Faber's minorant and Watson' sequence
Chap. 3. Semi-analyticity and differentiation: auxiliary theorems; semianalytical classes; formal properties of the asymptotical expansions
Chap. 4. Determination of a function by its asymptotical expansion disregarding the bounds sequence: strong-semianalytical functions; decomposition in sum of semianalytical functions; the optimal asymptotic approximation
Chap. 4. Application to summation of divergent series: summation of power divergent series; summation of numerical divergent series

Louisiana State U. [Baton Rouge].
CONTINUOUS HOMOMORPHIC IMAGES OF REAL CLANS WITH ZERO, by Haskell Cohen and I. S. Krule. Rept. on Contract AF 18(603)89. 5 June 58, 6p. 4 refs. AFOSR-TN-58-433; AD-158 237.
Order from LC mi$1.80, ph$1.80 PB 137 437

Maryland U., College Park.
OPERATORS AND THEIR FREDHOLM DOMAIN, by John W. Brace. Rept. on Contract AF 18(603)78. Sep 58, 24p. 19 refs. AFOSR-TN-58-851; AD-203 492.
Order from LC mi$2.70, ph$4.80 PB 138 049

This paper is concerned with the operator $I-\lambda T$, λ a complex number, I the identity mapping, and T a closed linear operator taking a Banach space X into itself. For a given y in X, the goal is to solve the equation $x-\lambda T(x)=y$ for x. The set of complex numbers called the generalized Fredholm domain for T is presented along with appropriate generalizations of the definition of the Fredholm radius. Making use of the Fredholm domain of type I, a very general class of operators having the spectral properties of compact operators is given. In analogy to the Fredholm method for integral equations, a method is given which is applicable in the Fredholm domain of type I. Though this method presupposes information about the eigen values, it may be used in reverse to determine such information.

Michigan U. [Research Inst.] Ann Arbor.
INHERENT ERRORS IN MATRICES WITH STATISTICAL APPLICATIONS, by Joseph Bryce Tysver. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Feb 58, 102p. 74 refs. 2144-213-T; AD-154 973.
Order from LC mi$5.70, ph$16.80 PB 138 467

The class of inherent errors evaluated in this study includes errors due to observation and measurement and does not include computational errors introduced by roundoff. The matrix operations are limited to the solution of linear systems. Additional development is made of the two usual methods of stating the effects of inherent errors: bounds and probability distributions. Second order increments are considered, new expressions for bounds are introduced, and distributional considerations are used in matrix operations for which such treatment is not presently available. An additional method of evaluation involves the determination of maximum values for the errors in the results of matrix operations. Application is made to the statistical problems of linear regression and analysis of variance for one-factor experiments.

Naval Ordnance Test Station, China Lake, Calif.
STURM-LIOUVILLE SYSTEMS WITH GENERALIZED BOUNDARY CONDITIONS, by L. C. Barrett and C. J. Thorne. 5 Aug 59, 27p. 3 refs. NOTS TP 2206; NAVORD rept. 6517; AD-225 490.
Order from LC mi$2.70, ph$4.80 PB 144 855

Theorems listing conditions and proofs are given for mathematical assumptions made in a previous report. Separation theorems locating the characteristics numbers of one-layer problems within intervals are given. (Author)

Naval Weapons Lab., Dahlgren, Va.
ON GENERALIZED GRID SCHEMES AND FINITE DIFFERENCES, by E. W. Schwiderski. 4 Nov 59, 47p. 7 refs. NWL rept. no. 1672.
Order from LC mi$3.30, ph$7.80 PB 144 946

This report introduces the "principle of complete interpretation of initial or boundary conditions" for the integration of partial differential equations which uses the geometry of prescribed domains of operation and the integral at the boundary. Rectangular grid schemes are generalized. The definition of ordinary finite differences is reformulated into new generalized differences. Laplace's equation is illustrated, and applications of generalized differences are cited. (Author)

[Office of Scientific Research and Development].
TABLES OF TRIGONOMETRIC FUNCTIONS TO FIVE SIGNIFICANT FIGURES, AND FOR EVERY TENTH OF A MIL. Sep 43, 330p. 2 refs. AMP rept. no. 24.1.
Order from LC mi$11.10, ph$50.10 PB 145 122

Pennsylvania U., Philadelphia.
HOMOMORPHISMS OF TRANSFORMATION GROUPS, by Robert Ellis and W. H. Gottschalk. Rept. on

Contract AF 18(600)1116. 30 Nov 58, 22p. 4 refs. AFOSR-TN-58-874; AD-203 914.
Order from LC mi$2.70, ph$4.80 PB 138 147

Results of the study show that a transformation group with compact phase space and non-compact phase group gives rise to a compact topological group called its structure group. Let (X, T) be a transformation group with compact phase space X and with arbitrary phase group T. There exists least invariant closed equivalence relations S_d and S_e in X such that T is distal on $X|S_d$ and T is equicontinuous on $X|S_e$. If (X, T) is locally almost periodic, then the 4 relations of S_d and S_e with the proximal and regionally proximal relations coincide. Such transformation groups are partially classifiable according to their structure groups.

P[erkin-]E[lmer] Corp., Norwalk, Conn.
A SINGULAR DIFFERENTIAL BOUNDARY PROBLEM, by David A. Shotwell. Rept. on Contract AF 33(616)5649. 30 Apr 59, 39p. 5 refs. WADC Technical rept. 59-319.
Order from OTS $1.00 PB 161 416

The purpose of this paper is to derive an expansion theorem, valid under suitable restrictions, for a function f(t) which is integrable on $(-\infty, \infty)$.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
PROPERTIES OF SECOND-ORDER CORRELATION FUNCTIONS, by J. Y. Hayase. Thesis. Rept. on Contract DA 36-039-sc-64637. 17 May 57, 68p. 47 refs. Technical rept. 330; AD-201 535.
Order from LC mi$3.90, ph$10.80 PB 145 267

The idea of correlation functions is extended to higher-order correlation functions. A definition of n^{th}-order correlation functions is given, and the general nature of these functions is considered. The emphasis is placed on the case n = 2. A survey of the ideas of stochastic process is given, and it is shown how it serves as a model for messages in a communication system. The second-order autocorrelation functions of periodic, aperiodic, and random functions are computed and plotted. Properties of second-order autocorrelation functions concerning continuity, behavior at the origin, phase effects of harmonics, and so forth, are considered. For periodic and aperiodic functions, the relation between the first- and second-order autocorrelation functions is given. The Fourier transform of second-order autocorrelation functions is investigated and a physical interpretation of this transform is given. Second-order crosscorrelation techniques are used to determine the location of random noise sources. (Author)

Stanford U., Calif.
CONSTRAINT QUALIFICATIONS IN MAXIMIZATION PROBLEMS, by Kenneth J. Arrow, Leonid Hurwicz, and Hirofumi Uzawa. Technical rept. no. 64 on Contract N6onr-25133. 22 Dec 58, 14p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 144 938

Stanford U., Calif.
AN INTEGER LINEAR PROGRAMMING MODEL FOR MACHINE SCHEDULING, by Harvey M. Wagner. Technical rept. no. 66 on Contract N6onr-251(33). 24 Dec 58, 19p. 13 refs.
Order from LC mi$2.40, ph$3.30 PB 144 932

Stanford U., Calif.
STABILITY OF THE GRADIENT PROCESS IN n-PERSON GAMES, by Kenneth J. Arrow and Leonid Hurwicz. Technical rept. no. 67 on Contract N6onr-25133. 29 Dec 58, 18p. 3 refs.
Order from LC mi$2.40, ph$3.30 PB 144 940

Syracuse U., N. Y.
DISCRETE POTENTIAL THEORY AND BOUNDARIES, by J. L. Doob. Research rept. no. 19 on Contract AF 48(638)265. Sep 58, 38p. 12 refs. AFOSR-TN-58-884; AD-204 102.
Order from LC mi$3.00, ph$6.30 PB 138 126

This report outlines the potential theory based on discrete parameter Markov processes and applies it to obtain the Martin exit and entrance boundaries in the chains (countable state space) case. (Author)

Syracuse U., N. Y.
ON SEMI-GROUPS OF POSITIVE MATRICES II, by W. B. Jurkat. Research rept. 21 on Contract AF 49(638)265. Sep 58, 18p. 13 refs. AFOSR-TN-58-931; AD-205 096.
Order from LC mi$2.40, ph$3.30 PB 138 127

Kolmogorov's differential equations of first and higher order are investigated from the viewpoint of semi-groups of positive matrices. (Author) (See also PB 139 320)

University Coll., Cork (Eire).
RESEARCH ON PROPERTIES OF THE COEFFICIENTS IN FOURIER SERIES WITH GAPS, by P. B. Kennedy. Technical (final) rept. on Contract AF 61(514)1399. 15 June 59, 7p. 9 refs. AFOSR-TR-59-115.
Order from LC mi$1.80, ph$1.80 PB 145 278

Size of coefficients in lacunary Fourier series of functions with certain continuity properties; some questions of convergence of such series; applications in regular-function theory.

Uppsala U. (Sweden).
STUDIES IN PERTURBATION THEORY. II. GENERALIZATION OF THE BRILLOUIN-WIGNER FORMALISM. III. SOLUTION OF THE SCHRÖDINGER EQUATION UNDER A VARIATION OF A PARAMETER, by Per-Olov Löwdin. Technical note no. 28 on Contract AF 61(514)1200. 15 June 59, 21p. 7 refs.
Order from LC mi$2.70, ph$4.80 PB 145 191

Part II. The solution of the Schrödinger equation by means of the variation principle and a discrete basis

leads to a certain secular equation. In a previous paper it was shown that, if this equation is handled by a partitioning technique, a generalization of the Schrödinger-Brillouin formula is obtained. The procedure contains an inverse matrix, and it is shown here that, if in the expression for the wave function this matrix is approximated to the M^{sh} order, the corresponding matrix in the expectation value for the energy is approximated to order $(2M+1)$. This gives a simple derivation and generalization of the Brillouin-Wigner theorem. The connection between the variation principle and perturbation theory is further discussed. Part III. The solution of the Schrödinger equation by means of the variation principle and a discrete but not necessarily orthonormal basis is studied in the case when the Hamiltonian $Tl = Tl(a)$ is a function of a parameter a. The coefficients in the power series expansions in a of the wave function and the energy are explicitly determined in the form of expectation values, and the connection with the conventional Schrödinger theory is discussed. (Author)

Virginia U., Charlottesville.
SEMI-COMPACT MAPPINGS, by Paul McDougle. Technical note no. 5 on Topology and Mathematical Analysis, Contract AF 49(638)72. July 58, 10p. 5 refs. AFOSR-TN-58-768; AD-201 923.
Order from LC mi$1.80, ph$1.80 PB 138 175

The semi-compact mapping property is introduced here for the purpose of relating certain properties that have been of importance in the study of decomposition spaces. Also, since certain equivalences have been established among space property invariants, mapping properties, and decomposition properties it has seemed feasible to introduce a system of spaces and mappings which characterize many decomposition space problems while obviating the decomposition construction. Particular attention is given the case where point inverses are connected and have bicompact boundaries.

Virginia U., Charlottesville.
STATIONARY POINTS FOR FINITE TRANSFORMATION GROUPS, by John Greever. Technical note no. 6 on Topology and Mathematical Analysis, Contract AF 49(638)72. Aug 58, 16p. 9 refs. AFOSR-TN-58-797; AD-202 230.
Order from LC mi$2.40, ph$3.30 PB 138 171

Let X be a finite-dimensional compact Hausdorff space and let G be a group of transformations of X into itself, A corollary to the Lefschetz Fixed Point Theorem asserts that F_G is non-empty when G is cyclic and X is triangulable and homologically trivial over R. From a theorem of P. A. Smith it follows that F_G is non-empty when X is homologically trivial over Z_p and G is of order p^{α}. It is the purpose of this paper to set forth results of this nature for groups of more arbitrary orders than those dealt with by the Lefschetz and Smith Theorems

Washington U., Seattle.
A COMPARISON OF SOME ANALYTIC METHODS OF ROTATION IN FACTOR ANALYSIS, by Edward F. Gocka. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). Feb 59, 169p. 29 refs.
Order from LC mi$7.80, ph$25.80 PB 144 824

The present study does not compare all analytic methods; it is restricted to a comparison of three analytic methods which are regarded as representative of the major trends in current analytic procedures. The results from the analytic procedures are compared with those obtained from known graphical procedures. Properties such as factorial invariance, which are quite adequately demonstrated for the graphical results, are used to evaluate the analytic results. The matrices to be rotated are selected so as to adequately sample the range of all possible positive manifold factor patterns for small matrices which have a complete and determinate simple structure.

Washington U., Seattle.
ON A CLASS OF PARTIALLY ORDERED SETS, by E. Michael. Technical rept. no. 5 on Contract Nonr-477(21). Mar 59, 5p. 1 ref.
Order from LC mi$1.80, ph$1.80 PB 145 211

In this note we consider a class of partially ordered sets, called partially well-ordered, and it is shown that they have some simple, desirable properties. As the name suggests, a simply ordered set is well-ordered if and only if it is partially well-ordered. Moreover, it is shown that any subset, finite cartesian product or image under an order-preserving map of partially well-ordered sets is partially well-ordered.

Wayne State U., Detroit, Mich.
STATISTICAL TECHNIQUES IN LIFE TESTING. CHAPTER II. TESTING OF HYPOTHESES, by Benjamin Epstein. Technical rept. no. 3 on Contract Nonr-2163(00). 1 Oct 58, 148p. 5 refs.
Order from LC mi$7.20, ph$22.80 PB 145 341

In the following we shall assume that the underlying p. d. f. of the life-time X is described by

$$f(x;\theta) = \frac{1}{\theta} e^{-x/\theta}, \quad x > 0, \ \theta > 0.$$

Our object is to test various hypotheses regarding the mean life θ on the basis of censored, truncated, or sequential procedures. (See also PB 134 345)

Computing Devices

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE AUTOMATIC DETECTION OF SCALING ERRORS IN AN ORDVAC-TYPE ARITHMETICAL ORGAN, by George W. Reitwiesner. Jan 56, 21p. 7 refs. Memo. rept. no. 966.
Order from LC mi$2.70, ph$4.80 PB 144 653

In preparing programming for the solution of problems by fixed radix calculating machines, program-

mers must scale the arithmetic to satisfy certain number-size restrictions which exist inherently in the functioning of the machines. In complicated problems this may not always be possible, and considerations of machine solution time may prohibit resort to programmed floating radix operation. A very definite advantage accrues when circuits are incorporated into the machine to recognize unanticipated violations of these restrictions and to effect appropriate alarm action when they occur. The ORDVAC contains no such circuits. All schemes considered heretofore for the addition of such circuits have appeared to require a significant quantity of equipment of distinctive design and function.

Computer Control Co., Inc., Wellesley, Mass.
FEASIBILITY STUDY FOR A KEYBOARD TYPE SELECTOR PLUGBOARD AND PLUGBOARD CHECKER, by Robert E. Michaud. Technical rept. no. 173 on Contract AF 30(602)1728. 20 June 58, 76p. 3 refs. RADC-TN-58-149; AD-148 752.
Order from LC mi$4.50, ph$12.30 PB 137 513

A study has been conducted to determine the feasibility of replacing a plugboard method of connecting logical elements by an automatic method, using a paper tape or a keyboard. Two possible means of implementation were considered: The telephone crossbar and the magnetic transfluxor with associated electronic circuits. The Transfluxor was adjudged to be superior, and a demonstration unit constructed to illustrate the logical design and circuit techniques involved. (Author)

Melpar, Inc., Falls Church, Va.
VOICE DATA PROCESSING SYSTEM, by L. P. Schoene, Jr. Scientific rept. no. 1 on Contract AF 19(604)5579. 15 Oct 59, 121p. AFCRC-TN-59-791.
Order from LC mi$6.30, ph$19.80 PB 144 797

The system programming, the results of a feasibility study, and the design and development of transistorized plug-in modules for a digital Voice Data Processing System are presented. This system, being fabricated to support the development by AFCRC of a speech bandwidth compression technique, is a special purpose computer operating from a 400 kilocycles-per-second clock. Several operational modes are provided to enable use of the Voice Data Processing System as a data accumulating and sorting device and then as a complete communication system simulator. The mathematical design analysis and the description of the operational evaluation tests for one of the circuit modules are included as appendices. (Author)

Michigan U. [Research Inst.] Ann Arbor.
THE LOGIC OF FIXED AND GROWING AUTOMATA by Arthur W. Burks. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Feb 58, 39p. 14 refs. 2144-231-T.
Order from LC mi$3.00, ph$6.30 PB 144 660

Computers may be classified in various ways: discrete versus continuous, synchronous versus asynchronous, deterministic versus probabilistic, fixed versus growing. When the word "automaton" is used in this paper without qualification, it will be to refer to discrete, synchronous, deterministic computers. In Sections 2 through 5 fixed automata are discussed, and, in Section 6, growing automata. Several languages for describing automata and methods for transforming expressions from one language to another are presented, and some general theorems concerning automata are stated and proved. Language and theory are, of course, intimately related: to state theorems about automata one must specify the class of automata under consideration, which can be accomplished by specifying the languages adequate to describe them. Automata languages have considerable practical importance for the process of logical design. (Author)

National Research Labs., Ottawa (Canada).
COMBINED ANALOG-DIGITAL SIMULATION OF ENGINEERING PROBLEMS, by F. W. Pruden. Oct 59, 17p. 7 refs. Mechanical engineering rept. MK-6.
Order from LC mi$2.40, ph$3.30 PB 144 887

A simple, but realistic dynamic system is considered, and the relative advantages of analog and digital methods of solution are investigated. For solution accuracy limited to 3 to 4 decimal digits the analog method is cheaper. However for certain mathematical operations such as long-term integration and generation of complicated functions, digital computer accuracy may be necessary. The coupling of analog and digital machines is discussed, and the relevant sampled-data theory is introduced. The stability of such combined systems in calculations is considered. Finally some examples of combined calculations are given. (Author)

Naval Ordnance Test Station, China Lake, Calif.
INVESTIGATION OF HIGH-FREQUENCY TRANSISTOR LOGIC CIRCUIT FOR DIGITAL APPLICATION, by Thomas Wong. 1 Aug 59, 104p. 18 refs. NOTS-TP-2319; NAVORD rept. 6588.
Order from LC mi$5.70, ph$16.80 PB 145 166

A discussion on the design of a logic module employing junction transistors is given. This package is designed as a standard module for logical operation in a digital computer, and employs "NOR" logic in place of the usual "AND", "OR", and "NOT" functions. In addition, the principle of threshold operation for the "NOR" circuit is introduced; this characteristic increases the versatility of the logical operation. The worst-case design philosophy was employed in the design technique. The circuit analysis of this module includes the various input and output loading conditions. A small-signal equivalent circuit for saturation operation is also presented. (Author)

Springfield Armory, Mass.
CORRECTIONS FOR POTENTIOMETER LOADING IN ANALOG COMPUTER COEFFICIENT POTENTIOMETERS, for E. H. Jakubowski. 6 Mar 59, 34p. Rept. SA-TR20-2807; AD-226 675.
Order from LC mi$3.00, ph$6.30 PB 144 941

A set of tables containing correction factors, which must be added to a potentiometer to compensate for

loading due to an input resistor of finite value, is presented. Procedure is described, and calculations given. (Author)

University of Southern California, Los Angeles.
THE ROLE OF HUMANS IN COMPLEX COMPUTER SYSTEMS: A DESCRIPTION OF THE STUDY, by Glenn L. Bryan, Joseph W. Rigney and others. Technical rept. no. 24 on Contract Nonr-228(02). Jan 59, 62p. 4 refs.
Order from LC mi$3.90, ph$10.80 PB 145 022

This report describes the background, rationale, and procedures employed to study personnel problems connected with programming and maintaining general purpose digital computers. Fifty computer locations were visited. Interview, observational, and questionnaire data were collected. Brief descriptions of the various data-collection techniques are presented. The substantive findings will be presented in the next three technical reports of this series. (Author)

University of Southern Calif., Los Angeles.
THE ROLE OF HUMANS IN COMPLEX COMPUTER SYSTEMS: MAINTENANCE, by Glenn L. Bryan, Joseph W. Rigney and others. Technical rept. no. 26 on Contract Nonr-228(02). Jan 59, 102p. 8 refs.
Order from LC mi$5.70, ph$16.80 PB 145 020

This investigation was designed (1) to observe and describe maintenance requirements and practices for digital computer systems now in use, (2) to examine the methods for screening, training, and evaluating computer technicians, and (3) to obtain up-to-date information on the organization and supervision of computer maintenance work. Visits were made to 50 representative computing centers in the United States on-site information was collected by means of observation, questionnaires, and interviews. The results presented provide a state-of-the-art summary regarding human factors problems in computer maintenance; they also serve to define computer personnel problems where future data are most needed.

University of Southern California, Los Angeles.
THE ROLE OF HUMANS IN COMPLEX COMPUTER SYSTEMS: PROGRAMMING, by Glenn L. Bryan, Joseph W. Rigney and others. Technical rept. no. 25 on Contract Nonr-228(02). Jan 59, 81p. 4 refs.
Order from LC mi$4.80, ph$13.80 PB 145 021

This report describes the results of research undertaken to develop and organize information about the role of humans in programming digital computers. It discusses programming practices and problems and pays special attention to the selection, training, and utilization of programmers. Information was collected by visiting 50 computers centers engaged in business, scientific, and military data-processing. Interviews, questionnaires, and direct observation were among the techniques used. Programming was found to be a process requiring the best talents of many different people. It appears that what is needed most for successful programming is a broad enough approach on the part of planners to encompass the diverse problems that are inevitable, but that so often are overlooked when programming is undertaken by a new group. A list of 50 summary statements is presented in the concluding section of the report. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
ON THE CONCEPTS OF A PROBLEM AND PROBLEM-SOLVING, by Richard Bellman and Paul Brock. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Mar 59, 26p. 12 refs. Rept. no. 2144-352-R.
Order from LC mi$2.70, ph$4.80 PB 145 108

This report discusses the concepts of a problem and problem-solving from the view point of concepts and limits of large-scale computers as a mathematical tool for the solution of major problem areas in modern technology. Typical problem areas include military ones such as combat surveillance and air defense. (Author)

MECHANICS

Ballistic Research Labs., Aberdeen Proving Ground, Md.
LAWS FOR LARGE ELASTIC RESPONSE AND PERMANENT DEFORMATION OF MODEL STRUCTURES SUBJECTED TO BLAST LOADING, by W. E. Baker, W. O. Ewing, Jr. and J. W. Hanna. Dec 58, 56p. 10 refs. Rept. no. 1060.
Order from OTS $1.75 PB 161 446

A model law is developed for scaling of response to blast loading of structures which undergo large elastic and plastic deformations. In the derivation of the model law, strain-rate and gravity effects are assumed negligible. The geometrical scaling of response predicted by the law is verified by a series of experiments on small cantilever beams. (Author)

Bolt Beranek and Newman, Inc., Cambridge, Mass.
DAMPING OF FLEXURAL VIBRATIONS BY ALTERNATE VISCO-ELASTIC AND ELASTIC LAYERS, by Eric E. Ungar, Donald Ross, and Edward M. Kerwin, Jr. Rept. for Dec 58-July 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5426. Nov 59, 45p. 10 refs. WADC Technical rept. 59-509.
Order from OTS $1.25 PB 161 425

A general analysis of damping due to N equal tapes is presented; the effect of using non-equal tapes is investigated for double tape applications. Suitable dimensionless parameters are used where possible in order to maintain generality. Previous work dealing with the damping of flexural vibrations by application of single "damping tapes" consisting of metal foils and dissipative adhesives is summarized and extended to multiple tapes. It is shown that additional tapes provide a considerable increase in damping at low frequencies, but only a very small increase at high

frequencies. It is found that multiple tapes and single tapes incorporating an equivalent amount of metal provide nearly the same damping, a fact which results in great design flexibility. Experimental and theoretically predicted results are shown to be in reasonabl/ good agreement. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE CONTACT PROBLEM FOR VISCOELASTIC BODIES, by E. H. Lee and J. R. M. Radok. Technical rept. no. 47 on Contract Nonr-562(10). Jan 59, 31p. 13 refs. C11-47.
Order from LC mi$3.00, ph$6.30 PB 144 863

The contact problem in viscoelasticity is one in which different types of boundary conditions are prescribed depending on whether boundary points inside or outside the region of contact are considered. Since, in general, the contact region varies with time, this leads to a problem which cannot be treated directly by application of the Laplace transform, which has formed the basis for most published viscoelastic stress distribution solutions. It is shown that the solution of the viscoelastic counterpart of the Hertz problem in elasticity can be deduced from the elastic solution by the method of functional equations. A particular example is presented, and the marked effect of viscoelastic behavior on the pressure distribution in the contact region is illustrated.

Brown U. Div. of Engineering, Providence, R. I.
A DIFFERENTIAL STRESS-STRAIN RELATION FOR THE HEXAGONAL CLOSE-PACKED ARRAY OF ELASTIC SPHERES, by J. Duffy. Technical rept. no. 3 on Contracts Nonr-562(14) and Nonr-266(09). Oct 57, 15p. 5 refs. 562(14)/3; AD-145 022.
Order from LC mi$2.40, ph$3.30 PB 137 548

A differential stress-strain relation is derived for a medium composed of a hexagonal close-packed array of elastic spheres in contact. The stress-strain relation is based on the theory of elastic bodies in contact, and includes the effects of both normal and tangential components of contact forces. Results are presented for an experiment performed as a test of the differential stress-strain relation. (Author)

[Defense Atomic Support Agency] Washington, D. C.
RESPONSE OF A FIXED ENDED RIGID FRAME TO TRANSIENT LOADING, by R. C. DeHart. 1 Nov 57, 40p. 3 refs. AFSWP-613; AD-151 333.
Order from LC mi$3.00, ph$6.30 PB 145 400

The response of a fixed ended rigid frame subjected to time dependent forces is determined. The Lagrange equation of motion, written in terms of the generalized coordinates for each of several normal modes, is used. The analysis shows that if the column mass is large and the time dependent concentrated load is applied at the column top, a rigid frame containing columns with fixed ends has a quite different bending moment response than an identical rigid frame containing pinned rather than fixed ends. For the case in which the dynamic load is uniformly distributed along a column, there is essentially no difference between the response of the frame with fixed ended columns and the response of the frame with pin ended columns. Changing the column ends from a pinned to a fixed condition does not materially change the time dependent deflections of the frame.

Illinois U., Urbana.
VIBRATIONS OF PRISMATIC BARS INCLUDING ROTATORY INERTIA AND SHEAR CORRECTIONS, by J. G. Sutherland and L. E. Goodman. Technical rept. on Contract N6ori-71, T.O. 6. 15 Apr 51, 28p. 16 refs. ATI-122 886.
Order from LC mi$2.70, ph$4.80 PB 138 124

The natural frequencies of beams, as predicted by the classical Bernoulli-Euler theory, are known to be slightly higher than those obtained in carefully controlled experiments. The difference between theory and experiment is almost completely removed, however, if consideration is given to the influence of rotatory inertia and shear deformation. This was first done by Timoshenko. Others who have contributed to an understanding of the importance of these effects include Jacobsen, Mindlin, Kruszewski, Fife and Wilbur, and E. Reissner.

Institute of Flight Structures, Columbia U., New York.
SHEAR BUCKLING OF BARS, by G. Herrmann and A. E. Armenakas. Technical note no. 3 on Contract AF 49(638)430. Oct 59, 14p. 1 ref. CU-7-59-AF-430-CE; AFOSR-TN-59-1016; AD-228 828.
Order from LC mi$2.40, ph$3.30 PB 144 762

It is shown that a perfectly straight bar, subjected to a state of uniform shear stresses will buckle, in a manner similar to a column under compression, if the shear stress exceeds a certain critical value. The buckling equations are obtained by the Newtonian approach, and also by the application of the principle of minimum potential energy. In order to provide additional insight into this buckling mechanism, a simple model is introduced and analysed. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
ON FINITE DEFORMATIONS OF AN ELASTIC ISOTROPIC MATERIAL, by Fritz John. Rept. on Contract AF 49(638)161. Oct 58, 69p. 6 refs. IMM-NYU-250; AFOSR-TN-58-955; AD-205 348.
Order from LC mi$3.90, ph$10.80 PB 138 255

This report contains some results on finite deformations of an ideal elastic material. The first chapter deals with a purely geometric question, which is quite independent of the physical properties of materials. Chapter II gives an exposition of the classical equations for ideal elastic isotropic materials. The relations

$$q_{ik} = \frac{\partial U(p)}{\partial p_{ik}}$$

between p and q which take the place of the stress strain relations are analyzed in more detail in Chapter III. In Chapter IV we consider changes in potential energy resulting from changes in the transforma-

tion $x' = f(x)$. Chapters V and VI derive the equations for bending of thin plates using Lagrange coordinates.

Martin Co., Baltimore, Md.
COMBINED EFFECTS OF AXIAL LOAD, THERMAL STRESS, AND CREEP IN FLAT PLATES, by P. C. Huang and C. J. Van Der Maas. Rept. for 1 Nov 56-31 Aug 57 on Structures Research at Elevated Temperature, Contract AF 33(616)3617. Mar 58, 145p. 3 refs. WADC Technical rept. 57-442.
Order from OTS $2.75 PB 161 087

This report presents methods for calculating the stresses and strains in unevenly heated flat plates. The methods are limited to the analysis of loadings in the plane of the plate and to temperature and strain distributions which are one-dimensional. The effects of plasticity, creep, and stability have been considered. Several experiments using 2024-T4 bare aluminum plates are reported in detail. It is concluded that the analytical methods have been verified by the experimental data. (Author)

Martin Co., Baltimore, Md.
COMBINED EFFECTS OF AXIAL LOAD, THERMAL STRESS, AND CREEP IN FLAT PLATES. LARGE DEFLECTION ANALYSIS OF BUCKLED PLATES UNDER THERMAL EFFECTS, by P. C. Huang and C. J. Van Der Maas. Rept. for 1 Oct 58-15 Jan 59 on Structures Research at Elevated Temperature, Contract AF 33(616)3617. Feb 59, 30p. WADC Technical rept. 57-442, supplement 1.
Order from OTS $0.75 PB 161 087-S-1

This report presents a method for calculating the post-buckling deflections, stresses, and strains in simply-supported flat plates which are evenly or unevenly heated. The analysis method is limited to uniaxial elastic-loads in the plane of plate and to one-dimensional temperature distribution. The method is applied to particular examples to demonstrate its use for calculating critical buckling loads and post-buckling behavior of plates subjected to the following temperature distributions: uniform, hot at the center varying linearly to cool at the edges, and cool in the center varying linearly to hot at the edges. The deflections and stresses resulting from these conditions are compared. An experimental verification for the method was sought using compression-buckling data from three tests. It was found that the theoretical data correlate satisfactorily with the experimental data. (Author)

Minnesota U., Minneapolis.
STEADY STATE RESPONSE OF A SIMPLE SYSTEM WITH A HYSTERETIC SPRING, by Edward R. Rang. Rept. for 1 June-31 Dec 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5426. July 59, 22p. 10 refs. WADC Technical rept. 59-121; AD-227 099.
Order from OTS $0.75 PB 161 091

The response of a simple spring-mass system is studied. The spring characteristics are chosen to simulate hysteresis loops found for systems in which the damping is due to the energy dissipation of materials or fabricated joints. Procedures for approximate calculation are outlined and an example is given. (Author)

Naval Research Lab., Washington, D. C.
MECHANICAL IMPEDANCE AS A TOOL FOR SHOCK OR VIBRATION ANALYSIS, by R. O. Belsheim and J. W. Young, Jr. Interim rept. 15 Feb 60, 31p. 78 refs. NRL rept. 5409.
Order from OTS $1.00 PB 161 022

This report introduces mechanical impedance to those already familiar with classical vibration theory. The impedance term is defined and discussed in detail. The analog between mechanical and electrical systems is noted and electrical circuit theorems which are especially applicable to mechanical systems are presented. In order to provide an introduction to the impedance concept, several simple mass-spring-dashpot systems are analyzed to obtain their impedance and the results are presented graphically. Since most structures are too complicated to yield to an analytical determination of impedance, methods for experimentally measuring mechanical impedance are discussed. Applications of impedance techniques for the general analysis of some shock and vibration problems are discussed. Material throughout the report is referenced and a fairly complete bibliography is included for those who would like more detailed information. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
NON-HOMOGENEOUS ELASTICITY, by Michael A. Sadowsky and Martin A. Goldberg. Rept. on Contract AF 49(638)202. Nov 58, 107p. 1 ref. AFOSR-TR-58-156; AD-162 280.
Order from LC mi$5.70, ph$16.80 PB 137 778

The report contains: table of notations; relations between coefficients of elasticity; orientational introduction; the problem of non-homogeneous elasticity in its general insoluble formulation; the principle of selective specializations leading to soluble cases; the generalized forms of the potential and bipotential equations; results for μ = const. and non-homogeneous elastic body in which the stress function equation in plane strain or plane stress remains $\Delta^4 \phi = 0$ or acquires additional linear terms with constant coefficients.

Watertown Arsenal Labs., Mass.
BUCKLING OF SHALLOW SPHERICAL SHELLS, by John F. Mescall. Nov 59, 23p. 13 refs. Technical rept. no. TR-836.32/1.
Order from LC mi$2.70, ph$4.80 PB 144 800

The buckling of a shallow spherical shell under uniform external pressure is investigated by application of the condition that the second variation of the total potential energy of the shell vanish. An approximate numerical estimate of the buckling pressure is obtained by means of a Rayleigh-Ritz procedure. (Author)

AER, Inc., Pasadena, Calif.
THEORETICAL STUDY OF THE INFLUENCE OF BLEED AREA ON AERODYNAMIC GROUND-INTERFERENCE PHENOMENA, by T. Kubota. Rept. on Contract N123(60530)14510A. 31 Mar 59, 98p. 9 refs. Technical rept. 115 (114-9-1); NOTS-TP 2324; NAVORD rept. 6592.
Order from LC mi$5.40, ph$15.30 PB 144 985

A theoretical analysis is carried out to determine the effects of bleed area on the ground interference of high-speed test sleds. At subsonic speeds a method is presented for estimating the bleed area effect of a lifting surface in an infinitely deep channel. For slender bodies an estimation of the bleed area effect is obtained by considering the two-dimensional flow in a transverse plane. At transonic speeds the transonic slender wing theory is extended to the case of ground interference, and the problem is reduced to that of finding a two-demensional incompressible flow in a transverse plane and an axisymmetric transonic flow around an equivalent body of revolution. Finally, at supersonic speeds the ground interference effects on slender bodies of revolution are analyzed by the method of Laplace transformation. (Author)

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
AN EXPLORATORY INVESTIGATION OF SOME AERODYNAMIC HEATING EFFECTS ON FLUTTER, by Sidney I. Gravitz. Rept. on Contract AF 49(638)219 Sep 58, 94p. 34 refs. ASRL Technical note 74-1; AFOSR-TN-58-972; AD-205 600.
Order from LC mi$5.40, ph$15.30 PB 138 125

An experimental and theoretical investigation is made of the effects of rapid change in Mach number on the flutter characteristics of supersonic wings; and the feasibility of utilizing a heated model in a low stagnation temperature wind tunnel to observe aerodynamic heating effects is studied.

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
MEASUREMENT OF PRESSURE DISTRIBUTIONS ON AN OSCILLATING WEDGE IN SUPERSONIC FLOW, by John R. Martuccelli. Rept. on Contract NOas-58-313-d. Oct 58, 43p. 7 refs. Technical rept. 71-2; NAVAER-5151; AD-210 874.
Order from LC mi$3.30, ph$7.80 PB 144 950

A series of pressure distributions over a wedge oscillating in pitch in a two-dimensional supersonic flow are presented for two Mach numbers, two surface angles, and three amplitudes of oscillation. In general the pressure amplitudes lie on or slightly above those predicted by linearized theory, while the phase angles are much lower than the theoretical values. A theoretical investigation, confirmed by a limited amount of experimental evidence, is also presented to show that flow discontinuities may be causing significant errors in the pressure measurements. (Author)

Aerophysics Development Corp., Santa [Barbara] Calif.
AN ACCOUNT OF RESEARCH INFORMATION PERTAINING TO AERODYNAMIC HEATING OF AIRFRAME BIBLIOGRAPHY. PART II. VOLUME 3, CONFIGURATIONS, by John F. Brahtz and Allan Dean. Rept. on Contract AF 33(616)2328. Mar 55, 81p. 297 refs. WADC Technical rept. 55-99; Pt. 2, vol. 3; AD-74 499.
Order from LC mi$4.80, ph$13.80 PB 145 065

Contents:
Types of construction
Exposed components
  Airfoils (wings, fins and stabilizers, control surfaces)
  Fuselage
  Nose cone
  Radomes
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Cooling (and heating) systems for exposed components
  Convection cooling
  Transpiration (sweat) and film cooling
  Ablation (melting surface) cooling
Joints
  Welds
  Riveted joints
  Brazed joints
  Adhesive bonded joints
  Surface to surface joints

Airesearch Mfg. Co., Phoenix, Ariz.
AERODYNAMIC CRITERIA FOR OPTIMUM DESIGN OF MIXED-FLOW IMPELLERS: EXPERIMENTAL RESULTS FOR IMPELLERS I AND IB, by J. L. Dussourd, N. Van Le, and D. E. Lewis. Rept. on Research on Mixed-Flow Compressors for Small Turbomachinery Application, Contract AF 33(616)2940. July 58, 152p. 13 refs. Rept. no. GT-5944-R; WADC Technical note 58-88.
Order from LC mi$7.50, ph$24.30 PB 144 669

This technical note reports the experimental results obtained on the performance of two mixed-flow impellers, designated as I and IB. These impellers are two of a series designed to provide information in formulating criteria for the aerodynamic designs of such compressors. Impellers I and IB represent compressor components aimed at a 5:1 pressure ratio and approximately 400 lb per min flow capacity. They are identical in meridonal shape, have identical inlet and exit conditions, have "medium-loaded" blades, and differ only in their respective blade shapes. The blade shape is such that the loading distribution is different, Impeller IB having a more highly loaded inducer. Each impeller, coupled with a vaneless diffuser, was tested extensively. Recorded test information includes over-all compressor calibration, impeller inlet survey data of total and static pressure, exit survey data of yaw angle, total pressures and temperatures at several peripheral positions, and shroud static pressures. The results indicate that little performance difference is detectable between the two impellers under all operating conditions. A discussion is presented of the performance results at conditions of subsonic, transonic, and supersonic flow relative to the inducer. (Author)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
INSTRUMENTATION FOR THE 5-IN. HYPERSONIC WIND TUNNEL AT FOREST GROVE STATION, by C. T. Holliday. Rept. on Contract NOrd-7386. 1 Oct 49, 50p. CM-576.
Order from LC mi$3.30, ph$7.80 PB 145 446

The requirements for satisfactory instrumentation of the blow-down type of wind tunnel differ somewhat from the requirements of the more conventional type of wind tunnel that is designed for continuous operation. Since static temperatures and pressures are very high and the time of supersonic flow is short the wind tunnel must be operated safely and automatically, and all data recording instruments must be automatic in operation and have a sufficiently high frequency response to accurately record all significant information. This report describes briefly the instrumentation of the five-inch hypersonic wind tunnel at the Forest Grove Station (near Silver Spring, Maryland) of the Applied Physics Laboratory, The Johns Hopkins University.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ENGINEERING DESIGN OF A WAVE SUPERHEATER FACILITY FOR HYPERSONIC RESEARCH AND DEVELOPMENT, by J. E. Carpenter. Rept. on Contract AF 18(603)141. Feb 59, 332p. 11 refs. Rept. no. AD-1118-A-2; AFOSR-TN-59-108; AD-210 224.
Order from LC mi$11.10, ph$51.60 PB 145 085

The engineering problems associated with the development of the 9000°R. Wave Superheater are presented in considerable detail. Included are the approaches that were pursued to attain a sound solution and the reasons for selecting the final engineering configurations. The major portion of the report is concerned with equipment selection and the background of engineering information required to perform the selection. Several Appendices are included which report in detail the results of various analytical and experimental studies. Specifications for the major items of purchased equipment are also included. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
MODIFICATIONS OF THE BASIC SHOCK TUBE TO IMPROVE ITS PERFORMANCE, by Anthony L. Russo and A. Hertzberg. Rept. on Contract AF 18(603)10. Aug 58, 50p. 11 refs. Rept. no. AD-1052-A-7; AFOSR-TN-58-716; AD-162 251.
Order from LC mi$3.30, ph$7.80 PB 144 524

Basic modifications are considered which would improve the performance of shock tubes in producing higher shock strengths and extend the use of hydrogen in generating strong shock waves in air. These modifications are the double-diaphragm driver with monatomic buffer gases and an area contraction at the diaphragm station. The results of this investigation indicate that the use of a shock tube with an area contraction and the proper monatomic buffer gas will permit the generation of strong shock waves, using cold hydrogen as a driver gas, with overall pressure ratios comparable to those required for combustion drivers. It is also shown that, by using a buffer gas with the proper atomic weight, the downstream diaphragm pressure ratio may be controlled to minimize the mass of the downstream diaphragm.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
STUDIES OF CHEMICAL NONEQUILIBRIUM IN HYPERSONIC NOZZLE FLOWS, by J. Gordon Hall and Anthony L. Russo. Rept. on Contract AF 18(603)141. Nov 59, 62p. 20 refs. Rept. no. AD-1118-A-6; AFOSR-TN-59-1090.
Order from LC mi$3.90, ph$10.80 PB 144 945

Analyses have been made of chemical nonequilibrium effects in pseudo-one-dimensional nozzle flows where the working fluid is a mixture of a dissociating species and inert diluent. Numerical examples computed on a high-speed digital machine are given for the critical flow of pure oxygen at a reservoir temperature of 5900°K over a wide range of reservoir pressures. From the examples discussed it appears that high reservoir pressures are essential to avoid significant nonequilibrium effects in hypersonic wind tunnel test flows of air and in rocket nozzle flows employing hydrogen-like propellants. For the rocket nozzle, the net effect of nonequilibrium is to make the specific impulse for infinite expansion ratio only weakly dependent on chamber pressure for a given chamber temperature.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
CALCULATION OF THE CROSS-STREAM WAVE LENGTH OF THE THREE-DIMENSIONAL TRANSITION PATTERN IN THE BOUNDARY LAYER ALONG A FLAT PLATE, by John R. Weske. Rept. on Contract AF 18(600)893. Nov 58, 30p. 10 refs. Technical note BN-150; AFOSR-TN-58-864; AD-203 671.
Order from LC mi$2.70, ph$4.80 PB 137 785

Observed three-dimensional transition motions in the boundary layer showing a pronounced pattern recurring periodically across the stream are analyzed under the assumption that secondary vorticity is a controlling factor and that viscous effects are of minor consequence. An optimum cross-stream wave length was computed which is numerically in agreement with experimental observations. The results of the computation point to the emergence of composite periodic vortex configurations. (Author)

Institute for System Research U. of Chicago, Ill.
AERODYNAMIC STUDIES: THE FORCES ACTING ON AN AIR VEHICLE: A REVIEW OF THE LITERATURE [PART 23] by M. Z. Krzywoblocki. Rept. on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Dec 59, 345p. 2183 refs. WADC Technical note 56-360, Part 23; AD-161 021.
Order from OTS $5.00 PB 161 442

The work is an annotated bibliography of the scientific literature pertaining to methods of calculating the aerodynamic forces acting on an air vehicle in flight. The present segment of the work includes material reviewed by the author in the period July-

Sep 57. The more interesting papers and reports (from the viewpoint of the aerodynamicist) are discussed briefly; others are listed without comment. (Author) (See also PB 161 140)

Institute of Engineering Research, U. of California, Berkeley.
SLIP FLOW OVER A SHORT FLAT PLATE, by J. A. Laurmann. Doctoral thesis. Technical rept. on Contract Nonr-222(45). 26 Dec 57, 37p. 9 refs. HE-150-152; Series no. 20, issue no. 116; AD-155 324.
Order from LC mi$3.00, ph$6.30 PB 138 005

Solutions of the compressible flow Navier-Stokes equations have been obtained for the problem of slip flow over a short flat plate at zero angle of attack by linearization for small values of the ratio of the plate length to the mean free path of the gas. A closed form solution was found possible in the incompressible case; in the compressible case a general discussion has been given in terms of splitting of the solution into transverse and longitudinal waves. It was found that the effect of viscous terms of order higher than boundary layer theory extends over distances at the leading and trailing edges of the order of $\frac{1}{\sqrt{\gamma}}$, and thus in many practical cases of interest are negligible. (Author)

Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy).
THE DISSOCIATION OF A PURE DIATOMIC GAS IN A LAMINAR BOUNDARY LAYER ON AN ADIABATIC FLAT PLATE, by Gianni Jarre. Technical note 10 on Contract AF 61(514)1124. Sep 58. 22p. 4 refs. AFOSR-TN-58-944; AD-205 082.
Order from LC mi$2.70, ph$4.80 PB 138 057

The present paper deals with the problem of the dissociation, produced by the friction heating, in a pure diatomic gas in a laminar boundary layer on an adiabatic flat plate at hypersonic Mach numbers. Two different and simplified methods are applied and give almost the same numerical laws describing the temperature-decay at the wall at the approaching of the chemical equilibrium state. Two numerical examples show that the considered case of dissociation is a very slow process. (Author)

Massachusetts Inst. of Tech., Cambridge.
GAS DYNAMICS OF FREE MOLECULE FLOW, by Alar Toomre. Rept. on Contract AF 49(638)207. Mar 58, 41p. 10 refs. Fluid Dynamics Research Group rept. no. 58-2; AFOSR Technical note no. 58-787; AD-202 114.
Order from LC mi$3.30, ph$7.80 PB 144 982

The influence of a solid object upon the velocity distribution of gas atoms in free molecule flow is studied. A concept of shadow flow makes it possible to consider two distinct velocity categories, and in principle facilitates the calculation of the velocity distribution function at any point in space. The interaction with the surface is considered in detail. The cosine dependence of diffuse reflection, in particular, is shown to be useful. (Author)

National Research Labs., Ottawa (Canada).
HALF-MODEL MEASUREMENTS OF LONGITUDINAL FORCE AND MOMENT CHARACTERISTICS OF AGARD MODEL 'B' AT SUBSONIC AND SUPERSONIC SPEEDS, by J. G. Laberge. Dec 59, 30p. 5 refs. Aeronautical rept. LR-267.
Order from LC mi$2.70, ph$4.80 PB 144 884

This report presents longitudinal force and moment characteristics of AGARD model 'B' as measured on a half model in the N. A. E. 30-inch x 16-inch high speed wind tunnel, over a Mach number range from 0.375 to 2.03. (Author)

Naval Ordnance Test Station, China Lake, Calif.
PRESSURE AND WAVE DRAG COEFFICIENTS FOR HEMISPHERES, HEMISPHERE-CONES AND HEMISPHERE-OGIVES, by Jerome R. Katz. 21 Mar 58, 23p. 13 refs. NOTS-1947; NAVORD rept. 5849; AD-159 801.
Order from LC mi$2.70, ph$4.80 PB 144 989

Experimental pressure and wave drag coefficients for hemispheres, hemisphere-cones, and hemisphere-ogives were compiled and compared with modified Newtonian theory for a wide range of Mach numbers. (Author)

Naval Weapons Lab., Dahlgren, Va.
TRANSONIC FLOWS PAST BLUNT BODIES OF REVOLUTION WITH DETACHED SHOCK WAVES, by E. W. Schwiderski. 2 Dec 59, 63p. 16 refs. NWL Rept. no. 1673.
Order from LC mi$3.90, ph$10.80 PB 145 153

An investigation of the intrinsic analytic properties of the quasi-linear mixed flow yields a flow model which contradicts the common well-known flow pattern in some fundamental points. Basically new concepts are formed which consider the whole transonic flow as an entirety. Based on the new flow model a numerical method is developed which constructs regular analytic transonic flow elements as an entirety. The method is founded upon generalized grid schemes and finite differences which were introduced in NWL Report No. 1672. The principal ideas of this method will be used for the construction of the final solution to the shock wave problem in a future report. The described method is programmed for NORC. The complete program and numerous samples of transonic flow elements will be given in another NWL Report. In this report only one example is discussed in detail.

Rensselaer Polytechnic Inst., Troy, N. Y.
SIMPLE SHEAR FLOW PAST A FLAT PLATE IN AN INCOMPRESSIBLE FLUID OF SMALL VISCOSITY, by Ting Yi Li. Rept. on Contract AF 18(600)1591. July 58, 47p. 15 refs. TR AE 5813; AFOSR-TN-[58]-718; AD-162 253.
Order from LC mi$3.30, ph$7.80 PB 137 905

We shall consider the simple shear flow past a flat plate in an incompressible fluid of small viscosity. This problem has been discussed in a number of recent articles by the present writer. However, in these articles the present writer did not expand his viewpoints fully mainly because of the limitation of these articles' length, and consequently there exist a number of obscure points which call for further discussion. In the present report, therefore, the author shall attempt to bring forth a more complete account of his solution.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
A TECHNIQUE FOR EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER FROM A SURFACE IN SUPERSONIC FLOW AT LARGE SURFACE-TO-FREE-STREAM TEMPERATURE RATIOS, by W. S. Bradfield, A. R. Hanson and others. Rept. on Contract AF 18(603)16. June 58, 31p. 5 refs. Research rept. no. 150; AFOSR-TR-58-64; AD-158 252.
Order from LC mi$3.00, ph$6.30 PB 144 952

A description is given of an experimental technique for studying heat transfer at high temperatures. The direction of heat flux is from the surface to the boundary layer. Preliminary values of local convective and radiative heat transfer are reported. Some data are given on the deterioration of graphite surfaces coated with silicon nitride and silicon carbide. (Author)

Technische Hochschule, Munich (West Germany).
RIEMANN'S PROBLEM FOR A LAVAL-NOZZLE, I. HYDRAULIC APPROXIMATION, by Rudolf Schätz. Technical note no. 9 on Contract AF 61(514)1080. 12 Aug 59, 23p. 5 refs. AFOSR-TN-59-709.
Order from LC mi$2.70, ph$4.80 PB 145 296

This report discusses hydraulic approximation of RIEMANN's problem, i.e., the determination of flow arising from discontinuous initial pressure distribution, for LAVAL nozzles, presenting a detailed analysis of numerical features of difference methods employed. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

Air Force Cambridge Research Center, Bedford, Mass.
A RELATIVISTIC TREATMENT OF STRONG SHOCK WAVES IN A CLASSICAL GAS, by Arnold W. Guess. Dec 59, 40p. 12 refs. GRD Research Notes no. 27; AFCRC-TN-59-642.
Order from OTS $1.00 PB 161 430

The relativistic Rankine-Hugoniot conditions of Taub are extended to include radiation pressure and energy density. The equations are specialized to the case of a classical gas in front of the shock (neglect of pressure and internal energy compared to rest mass energy density) and found to give strong shocks. Solutions are obtained separately for the cases of a pure material gas and a pure radiation gas behind the shock.

Experimental Towing Tank, Stevens Inst. of Tech., Hoboken, N. J.
AN EXPERIMENTAL STUDY OF THE EFFECT OF EXTREME VARIATIONS IN PROPORTIONS AND FORM ON SHIP MODEL BEHAVIOR IN WAVES, by Edward Numata and Edward V. Lewis. Rept. on Contract Nonr-263(10). Dec 57, 55p. 10 refs. Rept. no. 643; AD-154 980.
Order from LC mi$3.60, ph$9.30 PB 138 220

Results are presented of tests in regular and irregular waves of five models varying widely in form and proportions. Comparisions are given both among these models and with models tested in connection with other projects. It is shown that a low displacement-length ratio is a distinct advantage for reducing amplitudes of motions and, hence, for increasing speed at sea provided freeboard is adequate. The good sea performance of certain small craft with high displacement-length ratios appears to result mainly from ample free-board and, to a lesser extent, their V-form sections. It is shown that a good estimate of comparative performance of models of different form and proportions in irregular head seas can be obtained by suitable non-dimensional plots of motion amplitudes in regular waves of various lengths.

Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena.
MODIFICATION AND FLOW CALIBRATION OF TEST SECTION OF HIGH-SPEED WATER TUNNEL, by Robert W. Kermeen. Summary rept. on Task 4, Contract NOrd-16200. Dec 58, 7p. 3 refs. Rept. no. E-73-10; AD-210 194.
Order from LC mi$1.80, ph$1.80 PB 145 273

The test section of the High-Speed Water Tunnel (Trans. ASME, vo/, 70, no. 5, p. 437-457, July 48) was modified in preparation for experiments on the force and cavitation characteristics of torpedo fins and control surfaces mounted on a reflection plane. The modification involved installing a reflection plane in the 14-inch diameter working section of the tunnel. The reflection plane is described and the results of flow calibrations of the tunnel test section with the reflection plane installed are given. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ON THE ORIGIN AND MECHANISM OF VORTEX MOTION AT THE INLET OF INTAKES PLACED NEAR A FLAT SURFACE, by J. R. Weske. Rept. on Contract AF 18(600)893. Nov 58, 27p. 4 refs. Technical note BN-152; AFOSR-TN-58-863; AD-203 672;
Order from LC mi$2.70, ph$4.80 PB 137 784

Occurrence of vortex motion at the inlet of intakes is traced to the effect of the free flow upon the motion

in the boundary layer along the plate and to the generations of secondary vorticity. The flow is investigated experimentally and by preliminary theoretical analysis. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
A SOLUTION OF THE EQUATIONS OF STATISTICAL MECHANICS, by Robert M. Lewis. Rept. on Contract AF 49(638)341. Nov 59, 23p. 5 refs. Research rept. HT-3; AFOSR-TN-59-1216.
Order from LC mi$2.70, ph$4.80 PB 144 970

The solution of the initial value problem for Bogoliubov's functional differential equation of non-equilibrium statistical mechanics is obtained. This solution is then expanded in an infinite power series in the density which has the advantage that the calculation of the leading terms requires the solution of s-body problems only for small values of s. A derivation of the equilibrium equation by reduction from the non-equilibrium equation is included. (Author)

Iowa Inst. of Hydraulic Research, Iowa City.
THE ADDED MASSES OF PROLATE SPHEROIDS ACCELERATING UNDER A FREE SURFACE, by M. R. Bottaccini. Rept. on Contract Nonr-1611(01). Jan 59, 54p. 17 refs.
Order from LC mi$3.60, ph$9.30 PB 144 680

In this study we shall concern ourselves with the resistance of a fluid (treated as inviscid) to the acceleration of a wholly submerged body moving in the presence of a free surface. Specifically it is our aim to obtain usable expressions for those hydrodynamic force and moment components which tend to vanish whenever the acceleration of the submerged solid goes to zero.

James Forrestal Research Center, Princeton, N. J.
DETERMINATION OF TURBULENCE CHARACTERISTICS OF SOLID PARTICLES IN A TWO-PHASE STREAM BY OPTICAL AUTO-CORRELATION, by S. L. Soo, C. L. Tien, and V. Kadambi. Rept. on Project Squid, Contract Nonr-1858(25). Oct 58, 17p. 5 refs. Technical rept. PR-84-P.
Order from LC mi$2.40, ph$3.30 PB 145 723

Application of optical auto-correlation techniques enables determination of Lagrangian correlation, scale and intensity of turbulent motion of solid particles in a two-phase stream. This method allows measurement of both longitudinal and transverse correlations. (Author)

Technion Research and Development Foundation, Ltd. (Israel).
RESEARCH ON CROSS-STRESSES IN THE FLOW OF LIQUIDS, by Markus Reiner. Technical rept. for 1 Oct 57-30 Sep 58 on Contract AF 61(052)10. [1959] 27p. 12 refs. AFOSR-TN-59-37; AD-209 209.
Order from LC mi$2.70, ph$4.80 PB 145 168

Part I. An instrument is described which works as a centripetal vacuum pump. It consists of two circular metal plates, one stationary, the other rotating opposite it. The stator has an opening in the centre. The rotor can be freely displaced along the axis of rotation. By centripetal pumping action it is kept floating on an air cushion of thickness D. The relation between D and the speed of rotation was determined for different weights of the rotor to be supported. The results are interpreted on the basis of Maxwell's theory of the elastico-viscosity of air. Part II. An instrument is described which works as a centripetal pressure pump with incompressible liquids. (Author)

METALLURGY

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF A METHOD TO IMPROVE CASTINGS BY PRESS FORGING, by Andrew H. Murphy and Lyle L. Clark. Rept. for June 55-Dec 56 on Contract AF 33(600)30159. Mar 57, 217p. 12 refs. AD-140 817.
Order from LC mi$9.60, ph$33.30 PB 145 245

The effect of various press-forging and heat-treating conditions on the mechanical properties of Al, Mg, and Ti alloy castings was investigated. Optimum forging conditions (percent deformation, forging temperature, and heat-treatment prior to or after forging) were determined for a series of cast test bars of Al alloys 220 and 356, Mg alloy AZ92, and Ti-6Al-4V. The feasibility of utilizing a die block of cast Be-Cu alloy was demonstrated by press forging (to finished size and shape) 100 aircraft elevator control levers from Mg alloy castings; negligible die wear was observed. The improvement in the properties obtained by press forming Al 356 castings can be duplicated by increasing the normal aging time for this material. Mg AZ92 castings showed a marked improvement in physical properties when press forged with a 20% deformation. The increase in the strength of Al 220 press forged castings was proportional to the forging deformation. Ti-6Al-4V castings showed a very slight improvement in strength when subjected to press forging. The improvement imparted to production press-forged castings can be predicted by press forging cast test bars of the same alloy. (Portions of this report are illegible)

Massachusetts Inst. of Tech., Cambridge.
ON THE AGING BEHAVIOR OF THE ALLOY Ti-6Al-4V, by J. M. Dupouy, M. B. Bever, and B. L. Averbach. Technical rept. no. 2 on Physical Metallurgy of Titanium Alloys, Contract Nonr-1841(02). 31 Mar 59, 23p. 15 refs.
Order from LC mi$2.20, ph$4.80 PB 144 956

The effects of aging in the temperature range 800-1100°F (427-593°C) on the mechanical properties of the alloy Ti-6Al-4V were investigated. The amount of beta phase was measured as a function of aging time using an x-ray technique which employed a scintillation counter and a pulse-height analyzer.

Northwestern Technological Inst., Evanston, Ill.
AN ACOUSTICAL STUDY OF LOW-TEMPERATURE AGE-HARDENING AFTER REVERSION IN Al - 6 at.% Ag, by Herbert Herman and Morris E. Fine, 3 Dec 58, 19p. 25 refs. AFOSR-TN-58-1025; AD-162 292.
Order from LC mi$2.40, ph$3.30 PB 137 941

A study was conducted to determine the kinetics of re-aging after reversion in single crystals and to determine the mechanism of growth of Guinier-Preston zones. Two Al-6 at-% Ag single crystals, about 1.3 by 0.05 in. in size, were grown using a modified Bridgeman technique from ingots. The specimens were homogenized for 1 mo in a 550° C salt bath. For solution treatment, the specimen was contained in a sealed and weighted pyrex ampule evacuated to 10^{-6} mm of Hg which was suspended by a wire in a vertical furnace. For the quench, the wire was cut, allowing the ampule to drop into 25° water. Aging to the fully hardened state was attained by a 42-hr treatment at 100°C. Reversion was accomplished by heating for 15 min at 220°C. Plots were made for the fractional change of the resonant frequency from the initial reading to time t for re-aging after reversion at 50°, 70°, and 100°C. The re-aging reactions at 70° and 100°C were completed while the 50°C re-aging curve was 60% complete after 160 hr. Young's modulus decreased during concentration of Ag atoms into zones, the rate decreasing with increasing aging time. Zone formation occurred while the specimens were being warmed to the re-aging temperature. The decrease in modulus for the completed re-aging reactor was 2 of 3%. The total change from 1/2 hr to completion was less for direct aging than for re-aging after revision. Curves obtained for a crystal re-aged for 2 hr at 70°C and dropped to 50°C were extrapolated to 2.5 hr and indicated a 10 ± 2 Kcal/mol activation energy.

Watertown Arsenal Labs., Mass.
CHROMIUM PLATING ON TITANIUM ALLOYS, by Charles Levy. Nov 59, 22p. 12 refs. WAL TR 405/1.
Order from LC mi$2.70, ph$4.80 PB 144 877

Methods for plating on titanium, reported in the literature, have been investigated and evaluated. Average adhesion values ranged from 572 to 5785 psi for the various methods. Acid immersion zinc deposits which offer promise of conditioning titanium surfaces for electroplating were developed in laboratory experimentation. More research is needed to achieve adhesion of chromium plate to titanium comparable to that obtained on steel, which is of the order of 40,000 psi.

Wisconsin U., Madison.
SUMMARY DATA TABULATION OF 300 MB FLOW CHARACTERISTICS FOR THE NORTHERN HEMISPHERE, by James F. Lahey, Reid A. Bryson and others. Final rept., Pt. 2, on Contract AF 19(604)2278. Sep 59, 139p. 1 ref. AFCRC-TR-59-270.
Order from LC mi$6.90, ph$21.30 PB 144 796

This tabulation contains, in addition to the types of data presented in the atlas, listings of 300 mb densities and the number of days for which U, V, and UV data were available at each grid intersection.

Case Inst. of Tech. [Cleveland, Ohio]
AN INVESTIGATION OF SPECIAL TREATMENT FOR DEVELOPING HIGH TOUGHNESS IN ULTRA HIGH-STRENGTH STEELS, by C. W. Marshall, G. W. Form and R. F. Hehemann. Final rept. on Contract DA 33-019-505-ORD-8. Nov 58, 56p. 9 refs. WAL no. 310/214; AD-211 011.
Order from LC mi$3.60, ph$9.30 PB 144 878

A new hardening technique involves deformation of the austenitic structure (without recrystallization) prior to the martensitic transformation to yield pronounced improvements in strength and toughness of high-strength steels. The principal variables investigated were working temperature and amount and mode of deformation prior to quenching. Rolling of 4350 steel at 1000°F caused a significant increase in strength but lowered ductility and notch impact toughness. Deformation of austenite prior to quenching did not invariably lead to improvement in mechanical properties.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
SUPPLYING OF CAST TEST BARS FOR HIGH TEMPERATURE LEAN ALLOY STUDY, by J. Salvaggi. Final rept. for 19 Jan 53-30 Dec 56 on Contract NObsr-61335. [1957] 20p. 2 refs. Rept. no. KA-875-M-14; AD-144 946.
Order from LC mi$2.40, ph$3.30 PB 137 940

An investigation of the high-temperature behavior of modified chromium-nickel stainless steels in cast form has been conducted. A base analysis corresponding to a 17 Cr- 12 Ni- 2.5 Mo- 0.25 C stainless steel was modified by small additions of titanium, boron, and tungsten. The shell mold process was used to produce all cast test bars. Hot strength properties developed by the cast boron bearing compositions at 1350 and 1500°F compared favorably with those obtained for wrought material of similar compositions tested previously. These hot strength properties are in the same range as those of many of the super alloys containing appreciable quantities of strategic elements.

James Forrestal Research Center, Princeton, N. J.
SELF-DIFFUSION OF IRON IN NICKEL AND COBALT FERRITES, by R. H. Condit, M. J. Brabers and C. E. Birchenall. Rept. on Contract AF 18(600)967. July 58, 10p. 5 refs. Metallurgy rept. no. 18; AFOSR-TN-58-565; AD-158 383.
Order from LC mi$1.80, ph$1.80 PB 137 435

The self-diffusion of radioactive iron has been measured in nickel and cobalt ferrites in the temperature range between 844° and 1190°C. The rate of diffusion in the nickel ferrite is lower by about an order of magnitude than the diffusion in magnetite, and the rate in cobalt ferrite is about two orders of magnitude lower than the diffusion in magnetite. Iron diffusion in nickel ferrite appears to decrease with decreasing iron content. (Author)

National Bureau of Standards, Washington, D. C.
A STUDY OF 17-7 PH STAINLESS STEEL, by Nesbit L. Carwile and Samuel J. Rosenberg. Rept. for Jan 57-Dec 58 on Metallic Materials, Contract AF 33(616)57-7. June 59, 44p. WADC Technical rept. 58-653; AD-216 528.
Order from OTS $1.25 PB 161 089

A study was made of the mechanical properties and microstructures of 17-7 PH stainless steel as affected by heat treatment. Although optimum room temperature mechanical properties were obtained by a treatment slightly different from the TH 950 and TH 1050 treatments recommended by the manufacturer, the best tensile and stress-rupture properties at elevated temperatures (600° and 800°F) were obtained with the TH 950 treatment. When this steel in either the TH 950 or TH 1050 condition was subjected to prolonged exposure at 800°F, either with or without stress, a definite embrittlement resulted. The material may be restored to approximately its original properties by re-aging. Although extensive metallographic and X-ray examinations were made to ascertain the mechanism of aging and the precipitation-hardening compound, no definite conclusions were reached. The microstructure of this steel is extremely complex and could be a fertile field for study. (Author)

Naval Research Lab., Washington, D. C.
SOME OBSERVATIONS ON LOCALIZED BUCKLING OF CENTRALLY NOTCHED SHEET-STEEL SPECIMENS, by W. L. Bingham. Interim rept. 22 Dec 59, 8p. 1 ref. NRL rept. 5412.
Order from LC mi$1.80, ph$1.80 PB 143 015

Bending strains above a transverse slit in variously sized specimens of constant thickness have been used to indicate the presence of buckling. Buckling was found to occur only in the widest plate tested (48 inches); this is an observation in accordance with present elastic theory. Values of the transverse strains measured at positions ahead of the slit indicate the presence of a stress-relieving mechanism. This may be either a buckling deflection or a localized strain of the Luder-band type. (Author)

Rutgers State U., New Brunswick, N. J.
INHIBITION OF HYDROGEN EMBRITTLEMENT DURING PICKLING, by Leonard Dauerman. Quarterly progress rept. no. 13, 1 Jan-31 Mar 59, on Contract DA 30-069-ORD-1680. [1959] 38p.
Order from LC mi$3.00, ph$6.30 PB 145 503

Phenomena at Metal-Acid Solution Interfaces. Hydrogen diffusion. Possible Roles of Hexamine, and DHQ. (See also PB 144 392)

Watertown Arsenal Labs., Mass.
SUBSIZE CHARPY CORRELATION WITH STANDARD CHARPY, by Charles H. Curll. Dec 59, 26p. 3 refs. Technical rept. no. WAL TR 112/95.
Order from LC mi$2.70, ph$4.80 PB 144 923

The test data tend to verify a previously established nonlinear correlation between selected subsizes above the transition range and further indicate a linear correlation between the energy required to fracture standard-size and subsize V notch Charpy specimens at the normal acceptance testing temperature of -40°C.

Light Metals

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
A STUDY OF THE RELATIONSHIP BETWEEN NOTCHED AND UNNOTCHED SPECIMENS OF 2024 ALUMINUM ALLOY IN THE LOW-CYCLE FATIGUE REGIME, by Richard D'Amato and Robert De Boer. Rept. for 1 Mar 58-31 Dec 59 on Structural Design Criteria, Contract AF 33(616)3310. May 59, 80p. 6 refs. WADC Technical note 59-2.
Order from OTS $2.00 PB 161 405

An experimental fatigue investigation was conducted in the range of life between 1 and 10000 cycles to failure using notched and unnotched specimens of 2024 aluminum alloy. The notched specimens with theoretical elastic stress concentration factors of 2.0 and 4.0 were cycled between limits of deformation across the notch and the unnotched specimens were cycled between limits of elongation measured over a gage length of 3/4 inch. It was found that a linear relationship existed between range of deformation and cycles to failure when these variables were plotted on log-log coordinates and that the slope was the same for all three specimen configurations. In addition, when the strain-cycling data from each notch type was normalized to the failure strain, the data from all specimen configurations were found to lie within a relatively narrow band. The present investigation also indicated that the results of fatigue tests on notched specimens tested between limits of strain may be converted to stress-cycling results (S-N diagrams) by means of a stress-strain curve. (Author)

[Aeronautical Materials Lab.] Naval Air Material Center, Philadelphia, Pa.
ENDURANCE TESTS OF ALUMINUM AND MAGNESIUM CASTING ALLOYS CONTAINING VARIOUS DEGREES OF DISPERSED DISCONTINUITIES. Rept. on Endurance Tests of Aluminum Alloy AL-355 Containing Various Degrees of Porosity, Proj. TED NAM AE 4132. 14 Dec 54, 10p. 4 refs. Rept. no. AML NAM AE 4132, Pt. 2.
Order from LC mi$1.80, ph$1.80 PB 138 242

Fatigue strengths for porosity degrees Numbers 1 through 4 for aluminum casting alloy AL-355 in the solution treated and aged (T6) condition were determined. Based on the rising order of porosity and the fatigue strength taken as the stress corresponding to the fatigue life at 10,000,000 cycles, it was found that as porosity increased, the fatigue strength decreased from a maximum of 12,000 psi for degree Number 1 to a minimum of 9,000 psi for degree Number 4. Porosity degrees are illustrated by radiographic reproductions.

California U., Berkeley.
THE EFFECT OF HIGH TEMPERATURE RECOVERY ON THE CREEP OF POLYCRYSTALLINE ALUMINUM IN THE DISLOCATION CLIMB REGION OF TEMPERATURES, by W. D. Ludemann, L. A. Shepard, and J. E. Dorn. Rept. for 31 Jan 58-31 Jan 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3860. Dec 59, 34p. 32 refs. WADC Technical rept. 59-131.
Order from OTS $1.00 PB 161 422

Recovery of the creep resistance of 99.99% pure aluminum was studied at temperatures of 540°, 573°, 600°, and 611°K. Polycrystalline specimens crept under a stress of 950 psi to a strain of 5.5% were allowed to recover for periods of from one minute to sixteen days under a residual stress of 4.4 psi. Increased creep rates upon reapplication of the 950 psi stress evidenced softening of the material. The activation energy for the recovery process was found to be 64,000 cal/mole. Metallographic studies of the specimens showed relief of local elastic strains by coalescence of dislocations into sub-grain boundaries upon recovery, and sub-boundary migration. Indications of minor grain growth were also found. The activation energy of 64,000 cal/mole indicates that recovery of creep resistance was due primarily to the sweeping out of dislocations within the grains by the migration of sub-boundaries. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE WELDING OF TITANIUM AND TITANIUM ALLOYS, by G. E. Faulkner and C. B. Voldrich. Rept. on Contract AF 18(600)1375. 31 Dec 59, 69p. 38 refs. DMIC Rept. 122.
Order from OTS $1.75 PB 151 079

Information available to the Defense Metals Information Center on the welding of titanium and titanium alloys is summarized in this report. Welding is used to fabricate titanium and titanium-alloy components for air-frames, jet engines, missiles, and chemical equipment. Among the most important considerations in adapting titanium and its alloys to welded components is to use proper welding procedures and to select alloys that have the required weld-joint properties. The chemical and metallurgical characteristics that affect the selection of welding processes and alloys are discussed. Also, information is presented on surface preparation, welding procedures, and quality control. In addition, detailed data on the mechanical properties of welded joints in the commercial grades of titanium and titanium alloys and how these properties are affected by heat treatment and elevated temperatures are presented. (Author)

Manufacturing Labs., Inc., Cambridge, Mass.
INVESTIGATION OF THE STRENGTH AND DUCTILITY RELATIONSHIPS IN TITANIUM-ALUMINUM ALLOYS BETWEEN 6 AND 15% ALUMINUM FOR APPLICATION AT ELEVATED TEMPERATURES, by B. S. Lement, G. T. Hahn, and K. Kreder. Rept. for 28 May 58-14 May 59 on Contract AF 33(616)5948. Nov 58, 74p. 13 refs. WADC Technical rept. 59-342.
Order from OTS $1.75 PB 161 424

An investigation of the strength and ductility relationships in a series of Ti-Al alloys varying from 6 to 15% aluminum was carried out. The activation energy for the embrittlement reaction in a Ti-8Al alloy was found to be about 34,000 cal/mol, which is compatible with present knowledge of diffusion of aluminum or interstitial elements. More complete evidence was obtained that striations represent sub-boundaries that form as a result of the beta-alpha transformation and at which micro-segregation occurs. Striations can be eliminated by cold working and recrystallizing, or by quenching and recrystallizing. Rapid quenching results in a martensitic structure which exhibits high resistance to embrittlement on subsequent aging at 750°F in a Ti-8Al alloy. In the embrittled condition fracture takes place by trans-granular cleavage. (Author)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EFFECT OF HEAT TREATMENT ON THE METALLURGICAL AND MECHANICAL PROPERTIES OF 7AL-3MO TITANIUM ALLOY, by Paul L. Hendricks. Rept. for 18 Sep 57-13 Jan 59 on Metallic Materials, Contract AF 33(600)35886. Nov 59, 109p. WADC Technical rept. 59-263.
Order from OTS $2.50 PB 161 363.

Metallurgical and mechanical properties of 7Al-3Mo titanium alloy were determined on a production size heat. The investigation included heat treatment, the determination of tensile properties, stress rupture, creep stability, compressive yield, modulus, and impact strength. The conditions under which testing was accomplished varied from room temperature up to 1000°F. (Author)

Metals Research Lab., Brown U., Providence, R.I.
INFLUENCE OF THERMAL HISTORY ON PREFERRED ORIENTATIONS IN THE RECRYSTALLIZATION OF TECHNICALLY PURE ALUMINUM, by R. E. Green, Jr., B. G. Liebmann and H. Yoshida. Rept. on Contract AF 49(638)479. 15 Nov 58, 11p. 10 refs. AFOSR-TN-58-1014; AD-162 279.
Order from LC mi$2.40, ph$3.30 PB 137 931

The influence of the state of impurities (dissolved or precipitated) on the generation of preferred orientations in recrystallization of strained aluminum single crystals, has been investigated. The crystal contained 99.79% Al, 0.09% Fe, 0.09% Si and 0.03% Zn, only the iron not being well within its solid solubility limit. It is indicated that iron in supersaturated solid solution prevents the generation of preferred orientations while it has no effect of this kind when precipitated.

Nonferrous (except light) Metals

Climax Molybdenum Co. of Michigan, Detroit.
DEVELOPMENT OF MOLYBDENUM-BASE ALLOYS. PART I. HIGH STRENGTHS AND HIGH RECRYSTALLIZATION TEMPERATURES IN WROUGHT MOLYBDENUM-BASE ALLOY BAR STOCK. PART

II. MOLYBDENUM-BASE ALLOY SHEET MATERIALS, by M. Semchyshen, Gordon D. McArdle, and Robert Q. Barr. Rept. for Jan-Dec 58 on Metallic Materials, Contract AF 33(616)5447. Oct 59, 138p. 6 refs. WADC Technical rept. 59-280.
Order from OTS $2.75 PB 161 413

Some significant advances have been made in the development of Molybdenum-base alloys. Of several investigated, one exhibited an ultimate tensile strength at room temperature of 155600 psi and 101300 psi at 1800°F. Another showed a one hour recrystallization temperature in excess of 3200°F. A third alloy had a 100 hour rupture strength of 32700 psi at 2400°F. These represent the strongest known metallic materials for service at 1800°F to 2400°F. Nominally 1/16" thick sheet was fabricated from some of the alloys. While this sheet exhibited recrystallization temperatures comparable to those of wrought bar stock of the same composition, the tensile strengths and uniform elongations were lower for the sheet material. Annealing temperatures sufficient to recrystallize the cone of the alloy sheets were inadequate to recrystallize the extreme surface layers. This "case effect" is attributed to contamination of the surface during rolling and annealing. Bendability of the sheet alloys was substantially increased by milling off these outer layers. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE PROPERTIES OF BORON, by D. N. Williams. 4 Jan 60, 9p. 19 refs. DMIC memo. 41.
Order from OTS $0.50 PB 161 191

The element boron has properties that have given rise to speculation on its possible use as a structural material. However, considerable careful work in reduction and purification of boron has produced nothing encouraging. The purest material available today shatters at low impact, has no ductility, and such poor thermal-shock resistance that it breaks up on cooling slowly from the temperature at which it was produced to room temperature. This memorandum is written to collect as much authentic information as is available and to disseminate this to researchers who may be interested in the future potential and present limitations of boron.

National Bureau of Standards, Washington, D. C.
PREPARATION OF HIGH PURITY W, Mo, Ta, Cb, AND Zr, by Geo. A. Moore and L. L. Wyman. Rept. for Feb 58-Feb 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)58-11. Oct 59, 15p. WADC Technical rept. 59-314.
Order from OTS $0.50 PB 161 365

This project has been undertaken to prepare refractory metals of the highest possible purity in massive forms suitable for spectrochemical standards and for other essential applications. Experiments were made leading toward the preparation of purified volatile halides, taking advantage of fractional distillation and ion exchange reactions. An apparatus for the formation of refractory metal rods by the thermal decomposition of purified halides was completed. A large zone melting unit for the final purification of these rods was approaching completion at the end of the project year. In this unit electric bombardment heating is provided for the most refractory metals and an RF heating unit is provided for zone melting larger quantities of the less refractory metals. (Author)

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
THE SPECTRAL EMISSIVITY AND OPTICAL PROPERTIES OF TUNGSTEN, by Robert Dean Larrabee. Rept. on Contract DA 36-039-sc-64637. 21 May 57, 85p. 36 refs. Technical rept. 328; AD-156 602.
Order from LC mi$4.80, ph$13.80 PB 144 929

An experiment designed to measure the spectral emissivity of tungsten at incandescent temperatures has been initiated. A direct comparison method is utilized in which the radiant intensity from a tungsten source is compared with the radiant intensity from an approximative black body, and the spectral emissivity is computed from the basic relation $E_{\lambda T} = S/B$, where $E_{\lambda T}$ is the spectral emissivity at temperature T and wavelength λ, S is the radiant intensity of the tungsten source, and B is the radiant intensity of the approximative black body. It is shown that the spectral emissivity of tungsten is caused by the classical electromagnetic reflection and refraction of black-body light incident upon the metal-vacuum interface from inside the metal. Equations for the spectral emissivity of tungsten as a function of the direction of polarization and the angle of viewing the tungsten surface are developed in terms of the optical constants of tungsten. The optical constants of tungsten are computed by comparing these equations with the experimental data. An attempt is made to explain the main features of these data in terms of a combination of the Lorentz elastically bound electron theory of insulators and the Drude-Zener-Kronig free-electron theory of metals. (Author)

Structural Metallurgy and Corrosion

Battelle Memorial Inst., Columbus, Ohio
CAUSES OF CRACKING IN HIGH-STRENGTH WELD METALS, by A. J. Jacobs, R. P. Sopher and P. J. Rieppel. Rept. on Contract AF 33(038)12619. Aug 54, 35p. 5 refs. WADC Technical rept. 52-322, Pt. 3; AD-65 474.
Order from LC mi$3.00, ph$6.30 PB 145 332

Hot-tension and weld-metal cracking studies were conducted on SAE 43XX-type steels and other selected steels. Results from these studies showed a correlation, inasmuch as an increase in carbon, sulfur, and phosphorus tended to lower hot ductility and promote hot-crack susceptibility, and a misch metal addition seemed to have the opposite effects. (Author)

Case Inst. of Tech., Cleveland, Ohio.
THE PRESSURE DERIVATIVES OF THE ELASTIC CONSTANTS OF COPPER, SILVER AND GOLD, TO 10,000 BARS, by E. B. Daniels and Charles S. Smith. Technical rept. no. 1 on Contract Nonr-

1141(05). Jan 58, 35p. 30 refs. AD-219 023.
Order from LC mi$3.00, ph$6.30 PB 137 957

The pressure derivatives of the elastic constants of the homologous series of metals copper, silver and gold, were measured over the pressure range from 0 to 10,000 bars, using a modified ultrasonic pulse echo method. Means were devised to measure the change of elastic constant with pressure as directly as possible. The values found for the pressure derivatives of the elastic constants of copper, silver and gold are reported. The notation, $C = C_{44}$, $C' = (C_{11} - C_{12})/2$ and $B_S = (C_{11} + 2C_{12})_S/3$ was used. The data for each metal, of the three elastic constants and their pressure derivatives, were interpreted in terms of conventional theory. The theoretical contributions of long-range interactions were subtracted off and the remainder attributed to short range nearest neighbor interaction. The analysis indicates that these must be non-central, many-body interactions in order to account for the shear constants and their pressure derivatives. The many-body character of the interactions is of rapidly increasing importance in the sequence, copper, silver and gold.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
COMPOSITION FOR RAPID AND SIMULTANEOUS DERUSTING, DEGREASING AND RUST-PROOFING OF FERROUS SURFACES AT AMBIENT TEMPERATURES, by M. H. Swann. 8 Jan 58, 11p. CCL #40; AD-155 258.
Order from LC mi$2.40, ph$3.30 PB 145 043

The amount of Fe required to take into H_3PO_4 solution to prevent flash rusting was determined. At 5% Fe-phosphate content, the effect was first noticed. The effect increased as the concentration increased until at 15% excessive amounts of loose powdery deposits were left on the metal surfaces. The salts tested as additives included ferric and ferrous phosphates, ferric and ferrous oxalates, ferric and ammonium citrates, ferric sulfate, zinc oxalate, maganese phosphate, zinc phosphate, and combinations of the Na, K, and ammonium salts of oxalates and phosphates. In the presence of excess phosphoric acid as needed to remove rust, only ferric oxalate or combinations of ferric salts and alkali oxalates were protective. The effect of temperature, the weight of ferrous oxalate coating deposited, and the effect of time and temperature on coating weights were studied. A formula was developed that can be supplied in concentrated form for dilution with H_2O to facilitate shipping and storing; the formula exhibited an accelerated rate of rust removal. The formula is composed of ethylene glycol monobutyl ether in a water-soluble, acid-stable, nonionic surface-active agent used in aqueous medium containing H_3PO_4 and ferric oxalate.

Columbia U., New York.
INVESTIGATION OF THE ROLES OF ABSOLUTE GRAIN SIZE AND NUMBER OF GRAINS IN THE CROSS-SECTION AS FACTORS CONTROLLING FLOW AND FRACTURE STRESSES AT LOW TEMPERATURE, by James Wade Hill. Rept. on Contract AF 18(600)898. 28 Feb 58, 18p. 9 refs. AFOSR-TN-58-682; AD-162 215.
Order from LC mi$2.40, ph$3.30 PB 138 107

By variation of specimen size and grain size in a subgrain-free structure it is observed that absolute grain size and not the number of grains in the cross-section is the controlling factor in determining flow and fracture stress at low temperatures when all other factors are constant. (Author)

Hammond Metallurgical Lab., Yale U., New Haven, Conn.
THE MECHANISM OF INTERGRANULAR RUPTURE OF COPPER AND ALUMINUM AT HIGH TEMPERATURES, by W. D. Robertson and Raymond C. Boettner. Final rept. on Contracts DA 19-059-507-ORD-2597 and DA 19-059-ORD-1906. Jan 59, 120p. 60 refs. [AD-210 501].
Order from LC mi$6.00, ph$18.30 PB 145 175

Void-crack formation in creep was studied by means of density measurements and metallography in single crystals, bicrystals and polycrystals of copper of varying purity and polycrystalline aluminum of commercial purity as a function of stress, temperature and time. The importance of void-crack formation in analyses of creep curves and in the mechanism of penetration of liquid metals into solid nickels is discussed.

Massachusetts Inst. of Tech., Cambridge.
STUDY OF CRYSTAL STRUCTURES OF COMPLEX METALLIC PHASES, by David P. Shoemaker. Final rept. for 1 July 52-31 Aug 58 on Contract DA 19-020-ORD-1859. 1 Nov 58, 83p. 19 refs. OOR rept. 461.4 Met; AD-209 926.
Order from LC mi$4.80, ph$13.80 PB 145 178

Contents:
I. The crystal structure of the R phase, Mo-Co-Cr
II. X-ray diffraction studies of the δ phase, Mo-Ni
III. The crystal structure of the P phase, Mo-Ni-Cr
IV. Bonding in the transition-group intermetallic phases

Michigan U. [Research Inst.] Ann Arbor.
DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP AT TEMPERATURES TO 3500° F, by M. J. Sinnott. Progress rept. no. 14, 15 Aug-15 Sep [49] on Project NEPA. 15 Sep 49, 10p. [NEPA-1159-MIC-14] ATI-184 781.
Order from LC mi$1.80, ph$1.80 PB 137 450

The Geiger temperature indicating and recording unit (GETIR) has been successfully coupled to a motor-generator set to control the temperature of an induction-heated furnace. Life tests on a graphite induction furnace with no protection for the graphite show a life of approximately sixty hours at a temperature of 3300° F. A graphite induction furnace to operate with a protective atmosphere has been constructed and is currently being put into operation. Creep tests on a test sample of a carbide submitted by NACA were attempted, but oxidation and fluxing of the sample invalidated the test, which was run for forty-eight hours at 1800°F. at a load of 4000 pounds

per square inch. Creep tests on BeO samples are currently being attempted. Stability tests on ThO_2-Y_2O_3 heater rods have been started to determine the life of these units. (Author) (See also PB 138 461)

Midwest Research Inst., Kansas City, Mo.
RESEARCH ON THE MECHANISMS OF FATIGUE, by J. C. Grosskreutz and Fred R. Rollins. Rept. for Mar 58-Mar 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5065. Sep 59, 71p. 56 refs. WADC Technical rept. 59-192.
Order from OTS $2.00 PB 161 412

Small angle X-ray scattering from fatigued copper and aluminum reveals that the formation of misoriented subgrains is the most pronounced structural change occurring and that this formation is essentially completed within the first 10% of the fatigue life. It is demonstrated that high temperature annealing does not remove this polygonized structure, but does promote some growth and consolidation of the subgrains. The effect of annealing on fatigue life is discussed. No evidence has been found for the formation of voids in the volume of the samples during cyclic stressing. This result strongly favors the hypothesis that cracks originate at the surface. Electron micrographs have shown the existence of deep intrusions on the surface of copper samples run to fatigue. Energy dissipation during fatigue has been measured and found to follow the classic stages of fatigue. Reasons are discussed for discarding these stages in favor of a simple picture of crack initiation and crack propagation. A comprehensive state of the art survey is included. (Author)

Midwest Research Inst., Kansas City, Mo.
STUDY OF METHODS FOR NONDESTRUCTIVE MEASUREMENT OF RESIDUAL STRESS, by Fred R. Rollins. Rept. for 1 July 58-30 Sep 59 on Solid State Research and Properties of Matter, Contract AF 33(616)5932. Dec 59, 48p. 56 refs. WADC Technical rept. 59-561.
Order from OTS $1.25 PB 161 436

A rather thorough search for new techniques of measuring residual stresses has been conducted. This search has included a study of various physical phenomena which exhibit some stress dependent relationship. Of the many phenomena studied, ultrasonics was chosen for further experimental investigation. It has been definitely established that residual stresses in metals can cause double refraction of a polarized shear wave. A technique, based on the double refraction of shear waves, for measuring the average stress through certain specimens is described and sources of error are discussed. The interaction of two ultrasonic waves in metals has been investigated also. (Author)

Naval Boiler and Turbine Lab., Philadelphia, Pa.
CORROSION OF AN IRON-CHROMIUM-ALUMINUM ALLOY BY SYNTHETIC FUEL OIL ASH, by J. F. Kelly. Evaluation rept. 26 Aug 57, 15p. NBTL Test R-232; AD-147 472.
Order from LC mi$2.40, ph$3.30 PB 144 918

Tests were conducted on a Fe:Cr:Al alloy (25 Cr:4.6 Al: balFe). In synthetic fuel oil ash corrodants of high vanadium and of high sodium contents it had better resistance than type 310 alloy. Tests were conducted at 1700° for a maximum of 20 hours.

Physical Sciences Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
A STUDY OF METALLIC CORROSION BY X-RAY DIFFRACTION, by Otto Renius and Gerald P. Connell. Rept. on Contract DA 20-089-ORD-39246. Dec 59, 38p. 10 refs. Rept. no. RR-4.
Order from LC mi$3.00, ph$6.30 PB 145 011

Several metallic specimens, subjected to controlled corrosion, were studied by x-ray diffraction to determine the crystal structure of the base metal and the corrosion products. Diffraction patterns for various corroded and uncorroded, stressed and unstressed metals were obtained. The relationship between diffraction peak-to-background intensity ratios and the extent of corrosion was investigated. (Author)

Rock Island Arsenal Lab., Ill.
IN SITU CONVERSION OF OPERATING HYDRAULIC OILS TO PRESERVATIVE OILS, by R. L. LeMar. 26 Oct 59, 19p. Rept. no. 59-2773.
Order from LC mi$2.40, ph$3.30 PB 145 114

Fourteen commercial, inhibitor, additive concentrates were evaluated in four samples of used, operating hydraulic oil. A number of these concentrates were found to convert such an oil to an inhibited oil with preservative properties comparable to MIL-L-21260 oil. These additive concentrates were also miscible with the oil at room temperature and so could be added directly to the oil in the machine tool hydraulic system and mixed therein, by exercising the machine tool. Viscosity and flash point effects of the additive concentrates were also considered. A list of quality control tests for future selection of concentrates is included. (Author)

Rock Island Arsenal Lab., Ill.
PROCESS QUALITY CONTROL FOR CORROSION PREVENTIVE OILS AND COMPOUNDS, by Robert E. Johnson. 21 Oct 59, 24p. Rept. no. 59-2721; AD-228 438.
Order from LC mi$2.70, ph$4.80 PB 144 735

A quality control program was initiated and maintained in an attempt to insure the quality of preservative materials utilized in the storage of Ordnance materiel. The results obtained indicate that such a program is feasible and will provide valuable information if the personnel concerned are conscientious in the maintenance of necessary records. A satisfactory procedure was established to check periodically the preservative oils and fingerprint remover compounds. The use of a short fingerprint removal test considerably reduced the testing time. Additional work is necessary to establish a satisfactory procedure for the periodic check of solvent cutback and petrolatum type materials. Actual savings realized

from this program cannot be readily determined. However, periodic testing revealed deficiencies which were immediately corrected. A considerable amount of Ordnance materiel would have been preserved with deficient preservatives had it not been for this program. (Author)

Watertown Arsenal Labs., Mass.
ELEVATED TEMPERATURE CHARACTERISTICS OF THREE AGE HARDENED AND INTERNALLY OXIDIZED TITANIUM-COPPER-CERIUM ALLOYS, by Joseph M. Dhosi. Master's thesis. Dec 59, 57p. 16 refs. Technical rept. no. WAL TR-405.2/5.
Order from LC mi$3.60, ph$9.30 PB 144 922

The effects of solid solution strengthening by zirconium and tantalum on the precipitation hardening response of Ti-2.0Cu-0.4Ce were determined. Elevated temperature characteristics after aging and after internal oxidation were compared and it was found that the beneficial effects of each treatment are not additive. Internal oxidation was observed to improve the temperature stability of the base alloy.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Air Force Cambridge Research Center, Bedford, Mass.
NATURAL AEROSOLS AND NUCLEAR DEBRIS STUDIES, by M. I. Kalkstein, P. J. Drevinsky and others. Progress rept. no. 2 on Contract AT(49-7)1431. Nov 59, 44p. 17 refs. GRD Research Notes no. 24; AFCRC-TN-59-627.
Order from OTS $1.25 PB 161 368

Some additional results of research on radioactive and inactive aerosols in the troposphere and stratosphere are presented. Results of studies of stratospheric particulate aerosols and of the size distribution of fission products in the lower atmosphere are discussed. Techniques of particulate aerosol collection and analysis are described. Results for barium-140 and strontium-90 in individual precipitation samples are presented together with preliminary meteorological interpretation. Some results for gamma-ray activities in precipitation and soil samples are discussed. (Author)

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
RADIATION CHEMISTRY AND RELATED PHENOMENA. PART I. MECHANISMS OF RADIATION CHEMISTRY. PART II. RADIATION CHEMISTRY OF SATURATED ALIPHATIC HYDROCARBONS. PART III. RADIATION CHEMISTRY AS A PRECURSOR TO RADIATION EFFECTS ANALYSES, by Gordon G. Wepfer, Lowell A. King and William L. R. Rice. Rept. for Apr-June 59 on Materials Analysis and Evaluation Techniques. Nov 59, 91p. 12 refs. WADC Technical rept. 59-296.
Order from OTS $2.25 PB 161 414

It is known that when high-energy radiation passes through matter, energy is transferred to the target by ionization and excitation processes. Subsequently, any number of processes can and do occur, depending on the ionization density. Part I of this report is a summary of the mechanisms which can take place leading to the observed effects in radiation chemistry studies. The discussion is limited somewhat by a lack of knowledge of the extent to which the various secondary processes take place in a given system. It is possible, however, to discuss things which have been observed and the conditions under which certain processes are known to take place, processes which should be considered in studying any new system. Part II is a review of the radiation chemistry of pure saturated aliphatic hydrocarbons. Discussions and experimental observations found in the literature have been condensed and are presented. Part III is concerned with gross property changes resulting from interaction of radiation with materials. Programs to date in the radiation effects area are discussed. The relative success or failure of these various research efforts is indicated. An attempt is made to show the need for correlation of fundamental changes observed through radiation chemistry, and macroscopic changes observed in radiation effects studies. (Author)

Palmer Physical Lab., Princeton U., N. J.
STRANGE PARTICLE PRODUCTION IN COMPLEX NUCLEI, by Albert Eugene Werbrouck. Technical rept. no. 22 by Cosmic Ray and Elementary Particles Group on Contract Nonr-1858(06). 20 Feb 59, 100p. 45 refs.
Order from LC mi$5.40, ph$15.30 PB 144 723

Strange particle production by high energy pions and protons bombarding carbon, iron, and lead nuclei in a multiplate cloud chamber was investigated. This choice of targets provided an opportunity to compare the effects of multistage processes which are sensitive to nuclear radius. The two stage process that originally motivated the experiment was the indirect production of strange particles by pions in turn produced by a nucleon incident on the same nucleus. Early indications of very low direct production of strange particles in p-p collisions led to the belief that a large fraction of the production in p-nucleus collisions was through the indirect process. The result for this fraction in lead is $\sim 2/3$. A K-pair production by protons comparable to the direct production of hyperon-K meson pairs by protons was observed.

Stanford U., Calif.
NUCLEON FORM FACTORS FROM ELECTROPRODUCTION OF PIONS, by S. Gartenhaus and C. N. Lindner. Technical rept. no. 37 on Contract AF 49(638)388. Sep 58, 19p. 15 refs. AFOSR-TN-58-819; AD-202 351.
Order from LC mi$2.40, ph$3.30 PB 137 535

The dispersion relation analysis of Fubini, Nambu, and Wataghin [Phys. Rev. 111:329; 1958] for electropion production was applied to the experiments of Panofsky and Allton [Phys. Rev. 110:1155; 1958] as an independent means for studying nucleon structure.

The results are in qualitative agreement with those from elastic scattering experiments. Some of the limitations inherent in the form factor measurements by this process are also discussed. (Author)

Uppsala U. (Sweden).
NATURE OF THE TWO-ELECTRON CHEMICAL BOND I. THE HOMOPOLAR CASE, by Harrison Shull. Technical note no. 26 on Contract AF 61(514)1200. 5 June 59, 40p. 12 refs.
Order fr[illegible]C mi$3.00, ph$6.30 PB 145 190

By using the artifice of dividing space into two parts by means of a plane perpendicular to the internuclear axis and passing through its midpoint, it is shown that there is possible a division of a two-configuration two-electron wave function into two orthogonal parts each of which has optimum properties associated with the plane intuitively corresponding to the names "ionic" and "atomic". The division of the density distributions for the Wang, Weinbaum, and Rosen functions into ionic, atomic, and ionic-atomic cross-term parts is considered, and it is shown that the former two parts are roughly non-bonding, where as it is the latter part which contributes most to the density between the nuclei in the binding region. The term covalent seems best applied to the cross-term. The method is capable of extension to the heteropolar bond.

Elementary Particles

California U., Berkeley.
ELECTROMAGNETIC STRUCTURE OF THE NUCLEON, by Adam M. Bincer. Rept. on Contract AF 49(638)327. Nov 59, 35p. 17 refs. AFOSR-TN-59-1217.
Order from LC mi$3.00, ph$6.30 PB 145 041

Dispersion relations are proved for the electromagnetic and mesonic nucleon vertex functions considered as a function of the nucleon mass. The results are used to express the isotopic scalar and the isotopic vector electromagnetic form factors of the nucleon in terms of pion electroproduction (or photoproduction) and pion-nucleon scattering amplitudes in the $J = \frac{1}{2}$, $T = \frac{1}{2}$ state. (Author)

California U., Berkeley.
LOW-ENERGY π-MESONS IN THE COSMIC RADIATION, by Mircea Fotino. Technical rept. no. 41 on Cosmic Rays, Contract Nonr-222(40). 2 Feb 59, 47p. 39 refs.
Order from LC mi$3.30, ph$7.80 PB 144 899

The intensity of π-mesons in the atmosphere is investigated in the energy region $E_{kin} \lesssim 50$ Mev. at sea level and mountain altitudes. Positive π-mesons coming to rest in an absorber-scintillator are identified by the characteristic π-μ decay. They are detected electronically and recorded photographically. The value 1.45 ± 0.09 is adopted for the negative-to-positive ratio at small energies. The omnidirectional intensities J_{π^+} of slow positive π-mesons at sea level (91 m.), Echo Lake, Colorado (3260 m.), and Mt. Evans, Colorado (4310 m.) are found to be 0.0094 ± 0.0024, 0.098 ± 0.005 and 0.240 ± 0.011 $g^{-1}d^{-1}$ respectively. The altitude dependence of $J_{\pi^\pm}$, $J_{\mu^\pm}$ and $J_{\pi^\pm}/J_{\mu^\pm}$ is given and the attenuation length of slow π-mesons in the atmosphere found to be $L_a^\pi \approx 120$-$130 g/cm^2$ in this altitude interval. A discussion covering most of the available results along the same line is presented. (Author)

California U., Berkeley.
SPECTRAL REPRESENTATIONS IN PERTURBATION THEORY. III. THE SCATTERING AMPLITUDE WITH TWO COMPLEX INVARIANTS, by Jan Tarski. Rept. on Contract AF 49(638)327. [1958] 53p. 14 refs. AFOSR-TN-59-1071.
Order from LC mi$3.60, ph$9.30 PB 145 322

The partial Feynman amplitude corresponding to a particular fourth order diagram is examined as a function of energy and momentum transfer with both of these variables complex. The region of regularity of this function is found, and the types of singularities at the remaining points are determined. An approach which requires only elementary calculations is developed. The condition for the validity of Mandelstam's representation in the fourth order is obtained. Spectral representations for exchange scattering processes at fixed momentum transfer are discussed as another application of the principal results. (Author)

Convair, Fort Worth, Tex.
APPLICATION OF WIENER-HOPF METHOD TO TRANSPORT THEORY, by N. Edmonson. Rept. on Contract AF 33(600)32054. 8 Sep 58, 60p. 8 refs. MR-N-202; NARF-58-34T.
Order from LC mi$3.60, ph$9.30 PB 145 347

Milne's equation is derived as an example of an equation of the Wiener-Hopf type. The basic mathematical theory of the Wiener-Hopf method is developed and a number of physical problems solvable by the Wiener-Hopf method are presented. A discussion of the application of the Wiener-Hopf method to the non-homogeneous integral equation is included. (Author)

Convair, Fort Worth, Tex.
THE TWO-REGION NEUTRON TRANSPORT EQUATION, by T. W. Summers. Rept. on Contract AF 33(600)32054. 29 Dec 58, 24p. 4 refs. MR-N-220; NARF-58-53T.
Order from LC mi$2.70, ph$4.80 PB 145 345

The two-region neutron transport equation with plane symmetry has been solved by the Wiener-Hopf method for the case in which one region contains a plane, isotropic source parallel to the interface. The results are subject to the restrictions of isotropic scattering without loss of energy and a constant total mean free path. Analytical results are presented for the total flux and the angular flux at the interface. Numerical results for the total flux at the interface are presented in the form of a parameter study. (Author)

Illinois U., Urbana.
EVALUATION OF K^-- NUCLEON SCATTERING PHASE SHIFTS ON BASIS OF PRESENT DATA, by R. D. Hill. Technical rept. no. 7 on Contract Nonr-1834(05). Mar 59, 12p. 12 refs.
Order from LC mi$2.40, ph$3.30 PB 144 893

The purpose of the following evaluation was to try to obtain an estimate of the K^-- neutron elastic scattering cross-section. This is useful in planning a possible emulsion K^-- nuclear scattering analysis. Since the summer of 1958, when Dalitz carried out his evaluation of the phase-shifts, certain more complete experimental data, such as the inelastic K^--proton scattering cross-sections as a function of energy and the charge-exchange K^-- proton scattering cross-sections, have become available. A re-evaluation of the phase-shifts was therefore felt to be worth-while. (Author)

Miami U., Coral Gables, Fla.
NEGATIVE PION INTERACTIONS AT 1.3 $\frac{Bev}{c}$, by M. Blau, C. F. Carter and A. Perlmutter. Rept. on Contract AF 49(638)97. 10 July 59, 36p. 15 refs. AFOSR-TN-59-788; AD-220 514.
Order from LC mi$3.00, ph$6.30 PB 145 040

A total of 340 meters of track of negative pions of momentum 1.3 $\frac{Bev}{c}$ were followed in emulsion, and pion interactions were recorded. Special emphasis is placed on inelastic scattering on free protons (single meson production). The resulting angular and momentum distributions of the emitted particles are investigated and compared with previous experiments at similar energies. An attempt is made to explain these results on the basis of an isobar decaying into a nucleon and the slower pion. In the case of reaction $\pi^- + p \rightarrow \pi^- + \pi^0 + p$, it appears that there exists an anisotropy in the isobar frame of reference, in which the slower pion is emitted predominantly backward, with respect to the isobar direction. The results are compared with the π - π coupling model. Angular and energy distributions of mesons emitted in nuclear interactions are investigated and compared with other results and Monte Carlo calculations. The meson multiplicity and energy degradation in these collisions are also discussed. Strange particles found during the investigation are analyzed. (Author)

Stanford U., Calif.
FLUX AT SEA LEVEL OF HEAVY CHARGED PARTICLES PAIR-PRODUCED IN COSMIC-RAY SHOWERS, by A. Goldberg. Technical note no. 6 on Contract AF 49(638)388. Sep 59, 10p. 13 refs. AFOSR-TN-59-964.
Order from LC mi$1.80, ph$1.80 PB 144 964

The flux at sea level of charged particles with mass 300-600 electron masses is calculated assuming the particles to be pair-produced by cosmic-ray photons. The cross section for pair production, including the effects of nuclear size, is folded into the distribution of photons predicted by shower theory. Absorption of the produced particles is also considered approximately. The results are well below the experimental upper limit set up by Keuffel and co-workers. (Author)

Cyclotron Lab., U. of Illinois, Urbana.
MULTI-PURPOSE MAGNETIC PARTICLE ANALYZER, by Robert L. Burman and Avivi I. Yavin. Technical rept. no. 6 on Contract Nonr-1834(05). Mar 59, 28p. 10 refs.
Order from LC mi$2.70, ph$4.80 PB 144 895

A suggestion is made in this paper to apply Mileikowsky's idea of an astigmatic magnet to Enge's spectrometer.

Naval Radiological Defense Lab., San Francisco, Calif.
A SIMPLE CALIBRATION AND CHECKING FACILITY FOR FAST AND SLOW NEUTRON DETECTORS, by A. H. Redmond. 28 Jan 59, 20p. Research and development technical rept. USNRDL-TR-302.
Order from LC mi$2.40, ph$3.30 PB 145 614

A simple facility is described for checking the sensitivity of doserate instruments for fast neutron detection, and for calibration of thermal neutron detectors. About 7 million plutonium-beryllium neutrons per second give a tolerance flux density of slow neutrons from the walls of a cavity in paraffin or water. Construction drawings of the cavity are given, and for the dimensions specified the constant is given for converting any plutonium-beryllium flux of neutrons to combined thermal and epithermal flux densities, so that instruments can be calibrated in standard flux densities.

New York U. Coll. of Engineering, N. Y.
PLATEAU SLOPES AND PULSE CHARACTERISTICS OF LARGE, HIGH PRESSURE BF_3 COUNTERS, by Rosalind B. Mendell. Rept. on Contract AF 18(600)1555. July 59, 75p. 30 refs. AFOSR-TN-59-738.
Order from LC mi$4.50, ph$12.30 PB 144 936

Factors affecting the flatness of plateau of large diameter high pressure BF_3 counters were examined. It was found that with gas and counter body free from contamination, counters up to 5 cm radius and filled with BF_3 gas at 64 cm Hg had acceptably flat plateaus. Desired gas purity was obtained by generating the gas from CaF_2BF_3 complex, trapping residual impurities, and isolating and collecting BF_3 vapor that had been in equilibrium with the liquid phase at a vapor pressure of 20 cm Hg. The resolution of counters of different pressures and cathode diameter for ionizing events with a known energy spectrum was compared. Pulse amplification characteristics of the different counters were determined, and results, including the effect of electron attachment on measured values for counters of large diameter and high pressure are discussed.

Physical Sciences Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
INVESTIGATION OF OSCILLATING DOSIMETRY, by Otto Renius and Donald S. Sarna. 26 Oct 59, 21p.

5 refs. Rept. no. RR-2.
Order from LC mi$2.70, ph$4.80 PB 145 012

Quartz crystal oscillators, both wire and pressure mounted types, were subjected to X-radiation ranging from 28 KVP to 300 KVP to note the change in oscillating frequency with respect to the radiation dose received. Curves of frequency shift were plotted with respect to X-ray dosage to a megaroentgen level. Crystal dosimeters were heat treated after irradiation to return them to their initial frequency, and were then re-irradiated. AT cut quartz oscillator plates were not applicable as crystal dosimeters, however, the BT cut plates exhibited a frequency shift in proportion to the dose received. (Author)

Nuclear Engineering and Power

Ballistic Research Labs., Aberdeen Proving Ground, Md.
AIR BLAST MEASUREMENTS AROUND WATER-FILLED SIMULATED NUCLEAR REACTOR CORE VESSELS, by Wendell C. Olson and Harry Goldstein. July 59, 26p. 2 refs. Memo. rept. no. 1219; AD-226 238.
Order from OTS $1.00 PB 161 445

Measurements are presented of the air blast caused by bursting water-filled simulated nuclear reactor core vessels with internal explosive charges. The data were obtained by detonating one-pound spherical Pentolite explosive charges within the simulated cores and recording peak overpressures and positive impulses at each of several distances from 3 to 10 ft from the vessel center. The test data complement the results of previous experiments conducted by Larson and Olson in which air-filled simulated core vessels were burst by various energy sources simulating reactor runaway. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE ELASTIC-PLASTIC RESPONSE OF THIN SPHERICAL SHELLS TO INTERNAL BLAST LOADING, by Wilfred E. Baker. Feb 59, 38p. 7 refs. Memo. rept. no. 1194.
Order from OTS $1.25 PB 161 444

This report presents the results of a second analytical study, supplemented by some experiments, of the response of an idealized nuclear reactor containment shell to internal transient loading which could be caused by reactor runaway. The containment shell is assumed to be a thin spherical shell, and the transient loading is assumed spherically symmetric. The theory of the elastic-plastic response of the shell is developed for a blast loading which is intense enough to cause plastic flow. Solutions are obtained for both a linear model which neglects changes in shell radius and thickness, and a more exact non-linear model which accounts for these effects. Experimental checks of the theories are described. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE ELASTIC RESPONSE TO INTERNAL BLAST LOADING OF MODELS OF OUTER CONTAINMENT STRUCTURES FOR NUCLEAR REACTORS, by J. W. Hanna, W. O. Ewing, Jr. and W. E. Baker. Feb 59, 52p. 14 refs. Rept. no. 1067.
Order from OTS $1.75 PB 161 447

This report presents the results of an experimental study of the elastic response of four geometrically scaled models of nuclear reactor outer containment shells to internal blast loading. The character of response of the shells to dynamic loading is determined with the shells unsupported (suspended in air) and with the shells half-buried in the ground. Geometrical modeling of the response is verified for both support conditions. The results of a static pressure test of one vessel show that its dynamic response cannot be predicted from static considerations. (Author)

Nuclear Reactions

Texas Nuclear Corp., Austin.
NEUTRON INTERACTIONS IN LITHIUM, CARBON, NITROGEN, ALUMINUM, ARGON, MANGANESE, YTTRIUM, ZIRCONIUM, RADIOLEAD, AND BISMUTH, by Norman A. Bostrom, Ira L. Morgan and others. Rept. for 15 Mar 58-14 Mar 59 on Contract AF 33(616)5619. Feb 59, 150p. 96 refs. WADC Technical note 59-107.
Order from OTS $2.75 PB 161 406

An investigation of the interaction of neutrons in lithium, carbon, nitrogen, aluminum, argon, manganese, yttrium, zirconium, radiolead and bismuth has been made for various neutron energies. In particular the following measurements have been made: (a) The angular distributions of the neutrons inelastically scattered from yttrium and zirconium at neutron energies of 3.67 Mev and 4.21 Mev. (b) The angular distributions of the non-elastically scattered neutrons from yttrium and zirconium when bombarded with 15.2 Mev neutrons. (c) The energy distributions of the neutrons emitted from yttrium, zirconium, and radiolead when bombarded with 4.21 Mev neutrons. (d) The energy distributions of the neutrons emitted from yttrium and zirconium when bombarded with 15.2 Mev neutrons. (e) The cross section for production of gamma rays due to neutron interaction in lithium, yttrium, zirconium, and radiolead at an incident neutron energy of 1.01 Mev. (f) The cross section for production of gamma rays due to neutron interaction in yttrium and zirconium for neutrons in the energy region from 3.46 Mev to 4.59 Mev. (g) The gamma ray spectra produced from 14.9 Mev neutron interaction in yttrium, zirconium, and radiolead. (h) The angular distributions of the gross gamma rays from lithium, yttrium, zirconium, radiolead, and bismuth for an incident neutron energy of 4.21 Mev and for yttrium and zirconium at an incident neutron energy of 3.67 Mev. (Author)

Yale U., New Haven, Conn.
EFFECTS OF ATOMIC ELECTRONS ON p-p AND n-p SCATTERING, by G. Breit. Rept. on Contract AF 18(600)771. 15 Aug 58, 6p. 4 refs. AFOSR-TN-58-730; AD-162 265.
Order from LC mi$1.80, ph$1.80 PB 137 686

Radioactivity

Convair, Fort Worth, Tex.
ANALYSIS OF THE MOMENTS METHOD EXPERIMENT, by R. L. Kloster. Rept. on Contract AF 33(600)38946. 4 Sep 59, 31p. 11 refs. NARF-59-33T; FZK-9-138; AD-226 115.
Order from LC mi$3.00, ph$6.30 PB 145 630

Monte Carlo calculations show the effects of a plane water-air boundary on both fast neutron and gamma dose rates. Multigroup diffusion theory calculation for a reactor source shows the effects of a plane water-air boundary on thermal neutron dose rate. The results of Monte Carlo and multigroup calculations are compared with experimental values. The predicted boundary effect for fast neutrons of 7.3% agrees within 16% with the measured effect of 6.3%. An estimate of the boundary effect for thermal neutrons from PoBe source is obtained from the results of multigroup diffusion theory calculations for a reactor source. The calculated boundary effect agrees within 13% with the measured values. (Author)

Convair, Fort Worth, Tex.
MECHANISMS OF RADIATION DAMAGE: A SERIES OF LECTURES. Rept. on Contract AF 33(600)32054. 15 June 59, 332p. 47 refs. MR-N-232; NARF-59-28T; AD-225 541.
Order from LC mi$11.10, ph$51.60 PB 145 474

Contents:
Reactor spectra and their role in radiation damage calculations, by J. Romanko
Atomic displacements in solids during irradiation, by C. E. Morgan
Dislocation theory and plastic flow, by J. R. Streetman
Impeded motion of dislocations; Radiation effects, by J. R. Streetman
Stresses around neutron-induced defects in metals; Plastic flow, by J. R. Streetman
Organic chemistry, by A. B. Hoefelmeyer
Polymer chemistry, by P. M. James
Radiation chemistry, by A. B. Hoefelmeyer
Radiation damage mechanisms, by P. M. James
Mechanisms of radiation damage in organo-silicone, by T. W. Albrecht
Physical aspects of high-polymer systems, by E. G. Fritz
Rheological treatment of radiation effects in elastomers, by E. G. Fritz
Anti-rads and their mechanisms, by G. K. Abel
Molecular structure and radiation stability, by G. K. Abel

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Arctic Aeromedical Lab., Ladd AFB, Alaska.
WALK-AROUND SLEEPING BAG, by Harvey A. Buskirk. Apr 59, 17p. Technical rept. 59-4; AD-227 509.
Order from LC mi$2.40, ph$3.30 PB 144 849

A modification of the standard Quartermaster Mountain Sleeping Bag is proposed, which will render it useful both for sleeping purposes and for wear as an outer garment in a survival situation. The modification facilitates the addition of insulation, thus improving its heat conservation and allied characteristics. Economy of weight and bulk is realized because this dual purpose article can be integrated with the current clothing assemblies in a manner which will permit deletion of the conventional arctic parka. (Author)

Polacoat Inc., Blue Ash, Ohio.
FEASIBILITY STUDY AND DESIGN OF A SELF-ATTENUATING LIGHT VALVE, by John F. Dreyer. Rept. on Health Hazards of Materials and Radiation, Contract AF 33(616)5469. Oct 59, 21p. 14 refs. WADC Technical rept. 59-81.
Order from OTS $0.75 PB 161 433

Investigation of the phototropic phenomenon to determine the feasibility of phototropic material as a protective, self-attenuating light valve against the energy yields of high-intensity light sources has been accomplished. Although it has been found that the practical utilization of phototropic material as a protective eye device against an atomic flash is marginal, its use as a sunglass appears to be feasible. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
A FIELD TEST OF CANAIGRE-TANNED HEAVY LEATHER IN LOW QUARTER SHOES, by Ludwig Seligsberger, Charles W. Mann, and Joseph Naghski (Hides and Leather Lab.). Oct 59, 26p. 16 refs. Footwear and Leather Series rept. no. 15.
Order from LC mi$2.70, ph$4.80 PB 144 533

The service characteristics of these shoes were studied over a period of 14 months. Details of the tanning trial and the field test are described. Only minor, if any, differences between the shoe components made from canaigre and from standard leather were noted - except for the wear resistance of the outsole. The wear resistance of the outsoles was measured by comparing losses in outsole thickness before and after wear. By this method, oil-treated canaigre soles showed a 22% greater loss than oil-treated standard soles. This difference is sufficiently small to warrant the conclusion that the leather industry could produce canaigre-tanned leather as good as heavy leather tanned in the conventional manner, if it were to direct its efforts toward that goal. The field test, therefore, may be considered as an encouraging first step toward establishing canaigre as a domestic replacement material for critical and strategic tanning imports.

Quartermaster Research and Engineering Center, Natick, Mass.
TEST OF THREADS FOR FOOTWEAR CONSTRUCTION CONSIDERING THE EFFECT OF STORAGE, by Edward B. Frederick. Oct 58, 30p. Footwear and Leather Series rept. no. 14.
Order from LC mi$2.70, ph$4.80 PB 138 411

This study was undertaken to determine the optimal thread and cord combination for stitching the uppers and bottoms of leather combat footwear in order to extend its service life. The effect of a two-year storage period, under both temperate and tropical conditions, on the stress-strain properties of selected threads and cords was investigated. The threads and cords were stored in skeins and in a wrapped-around-leather condition. Service shoes stitched with various combinations of these threads and cords were also stored. The threads and cords were laboratory tested periodically during storage and again at the end of the two year period. The shoes were visually examined periodically and, after the complete storage period, they were wear-tested. The laboratory test results showed the strength loss of the nylon threads to be negligible during storage. The shoe wear test results showed the nylon thread to be significantly more durable for upper stitching than any of the other threads tested. In the laboratory, the nylon and polyester cords were found to be about equal during the storage period. Both lost less strength than either the cotton or linen cords. As a result of the shoe wear test, the durability of all of the bottom stitching cords was indicated to be about equal. (Author) (See also PB 140 252)

PHYSICS

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TECHNICAL PAPERS FROM THE QUARTERLY REVIEW OF BUMBLEBEE ACTIVITIES, JANUARY-JUNE 1957. Rept. on Contract NOrd-7386. [1957] 48p. 15 refs. Bumblebee rept. no. 270.
Order from LC mi$3.30, ph$7.80 PB 145 094

Contents:
Material transport in a laminar propane-air flame front
Material strengths under missile load conditions
Transistor IF amplifiers
Calculation of fluid flow in a variable-area can combustor
Use of thermistors in precision thermal conductivity gas analyzer
Approximate method for calculation of ogive-cylinder aerodynamic characteristics
Design of an acceleration insensitive skin-friction balance for supersonic flight
An investigation of the fine structure of turbulent flows
Automatic recording wave analyzer for analysis of vibration data

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 3. PHYSICS (PART I). 373p.
Order from OTS $3.75 PB 161 135

Contents:
Multiple subfields of physics
Astronomy and astrophysics
Atomic and molecular
Biophysics
Electricity and magnetism
Electromagnetic waves
Electron physics
Heat and thermodynamics
Light and optics
Nuclear physics
Sound and acoustics
(See also PB 151 496)

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 4. PHYSICS (PART II) AND GEOPHYSICAL SCIENCES. 375p.
Order from OTS $3.75 PB 161 136

Contents:
Physics (Part II):
Mechanics (except solid state)
Solid state physics
Geophysical Sciences:
Cartography and geodesy
Earth physics
Geography
Geology and geophysics
Meterology
Oceanography
(See also PB 151 497)

Diamond Ordnance Fuze Labs., Washington, D. C.
THE DISCONTINUOUS POTENTIAL OF AN AXIALLY SYMMETRIC CHARGE ON A SPHERE, by Chester Snow. 1 Oct 59, 39p. 2 refs. TM-59-8.
Order from LC mi$3.00, ph$6.30 PB 144 709

If a sphere is covered with a thin metallic foil which is cut along some circle, its two parts may be kept at different potentials. The limiting case where this insulating cut is infinitely thin leads to a surface potential with finite discontinuity. The potential function at all points inside and outside the sphere may be evaluated by exact formulas so the surface density of electric charge on each cap may be computed, not only when the sphere is isolated, but also when it is any height above a conducting plane. (Author)

Maryland U., College Park.
DETERMINATION OF THE SUPERCONDUCTING SKIN DEPTH FROM THE ENERGY GAP AND SUM RULE, by M. Tinkham (U. of California) and R. A. Ferrell. Rept. on Contracts Nonr-1797(00) and 222(58). Feb 59, 13p. 18 refs. Physics Dept. Technical rept. no. 131.
Order from LC mi$2.40, ph$3.30 PB 144 780

It has previously been pointed out that the oscillator strength sum rule provides a useful relation between

the energy gap in a superconductor and the strength of the supercurrent which flows in response to an applied low frequency field. A direct consequence is the effect of impurities in increasing the penetration depth. The purpose of the present note is to extend these arguments to the case of an ideal pure bulk superconductor.

Acoustics

Aeronautical Accessories Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
RANDOM VIBRATION SIMULATION, by Neal Granick. Status rept. on Destructive Noise and Vibration. Nov 58, 18p. 12 refs. WADC Technical note 58-274; AD-203 125.
Order from LC mi$2.40, ph$3.30 PB 145 147

The status of random vibration research as it pertains to problems in simulation is reviewed critically. Areas of experimental research are suggested which eventually may determine the extent to which random vibration should be used in the laboratory. The continued use of sinusoidal vibration techniques for the simulation of noise-induced vibration appears justified on the basis of existing knowledge and economic considerations. (Author)

Naval Ordnance Test Station, China Lake, Calif.
INTEGRATED WHITE NOISE, by Roy Leipnik. July 59, 14p. NOTS TP-2370; NAVORD rept. 7013.
Order from LC mi$2.40, ph$3.30 PB 145 127

The autocovariance of n-times finite-integrated band-limited white noise is calculated in terms of exponential-integral functions. Asymptotic results are obtained for large and small band-width limits, and error-bounds are given, with a view toward error-analysis of integrated accelerometers. (Author)

Ordnance Research Lab., Pennsylvania State U., University Park.
A THEORY OF REFLECTIONS FROM GRADUAL-TRANSITION SOUND ABSORBERS, by Norman V. Miller. Rept. no. 46 on Contract NOrd-16597. 15 Dec 58, 47p. 14 refs. AD-208 109.
Order from LC mi$3.30, ph$7.80 PB 144 963

In this report, reflections from gradual-transition linings for anechoic tanks are treated theoretically by considering the propagation of compressional waves in stratified media. Typical linings are considered in detail to determine theoretically the proportion of transition width to total lining width that produces minimum reflections. A comparison of the theoretical results with experimental data for a cone-type underwater lining indicates that the one-dimensional theory gives useful results for cone and wedge linings.

Electricity and Magnetism

Aerosciences Lab., General Electric Co., Philadelphia, Pa.
MAGNETOHYDRODYNAMIC CHANNEL FLOW OF A PERFECT GAS FOR THE GENERATION OF ELECTRICAL POWER, by G. W. Sutton. Rept. on Contract AF 04(647)269. 8 Dec 59, 34p. 9 refs. Technical Information Series R59SD473.
Order from LC mi$3.00, ph$6.30 PB 145 184

This report considers the channel flow of an ideal compressible gas which is slightly ionized, for the purpose of generation of electrical power. Analytical expressions are derived for the flow variables for flows of constant velocity, temperature, pressure, density and area.

Carnegie Inst. of Tech., Pittsburgh, Pa.
ELECTRIC FIELD DISTRIBUTION IN AN IONIZED GAS. I, by Michel Baranger and Bernard Mozer. (Doctoral thesis). Technical rept. no. 1 on Contract Nonr-760(15). [1959] 19p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 144 897

A method for improving systematically the Holtsmark distribution is described. It is based on a cluster-type expansion and takes into account increasing orders of correlation. In this paper, it is applied to the calculation of the distribution of the high-frequency component of the electric field in an ionized gas in thermal equilibrium. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
ATMOSPHERIC WHISTLERS AND THE ELECTRON DENSITY IN THE IONOSPHERE, by F. H. Shammatt. Rept. on Contract AF 19(604)5504. 21 Oct 59, 26p. 10 refs. Rept. no. 6-30; AFCRC-TN-59-790.
Order from LC mi$2.70, ph$4.80 PB 144 968

Some of the electromagnetic energy released from lightning strokes travels a path through the ionosphere essentially parallel to the magnetic lines of the earth's magnetic field. It arrives at the ground in the opposite hemisphere as a frequency dispersed wave train with time delay increasing with decreasing frequency. This report presents a method of computing the dispersion from a knowledge of the electron density and compares observed and computed dispersions based on an assumed exponential electron density height distribution.

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
IMPROVEMENTS IN DESIGN OF THE FIVE-STRING PENDULUM MAGNETOMETER, by C. H. Nowlin. Scientific rept. no. 14 on Contract AF 19(604)1084. 10 Sep 58, 34p. 4 refs. AFCRC-TN-58-554; AD-160 863.
Order from LC mi$3.00, ph$6.30 PB 137 792

Attention was given to the experimental and theoretical problems of measuring the saturation magnetic

moment per gram of various magnetic materials. A five-string pendulum magnetometer is used and the sample is located in a non-homogeneous field. A description and pictures of a practical operating system (including automatic timing) are shown. Sources of possible error are pointed out, together with the methods of suppressing them, which enabled us to limit our error to a maximum of 3 per cent. Furthermore, equations are derived showing the exact effect of using simply shaped pole caps, e.g., spherical, instead of hopefully assuming that all will be well if one limits operation to a small region near the center of the pole gap. (Author)

Electronics

PLASMA: BIBLIOGRAPHY. Suppl. to Electric Discharges in Gases and on Plasma: Annotated Bibliography. 28 Jan 59 [13]p. AF 1255489, Suppl. to AF 1255488.
Order from LC mi$2.40, ph$3.30 PB 142 618

Consists of entries from Western open sources, 1955-58.

A bibliography on plasma covering the publications of the United States, England and France and which is a supplement to AF 1255488 entitled "Annoted Bibliography on Electric Discharges in Gases and on Plasma" dated Jan. 28, 1959 covering publications from Soviet open sources, 1950-1958 (technical translation 59-12981).

Air Force Cambridge Research Center, Bedford, Mass.
THE McGILL SYMPOSIUM ON MICROWAVE OPTICS JUNE 22-25, 1953. PART I. MICROWAVE OPTICS, by B. S. Karasik and F. J. Zucker. Apr 59, 142p. 156 refs. AFCRC-TR-59-118(I); AD-211 499.
Order from OTS $2.75 PB 161 450

Contents:
Lenses and reflectors
Caustics and aberrations
Fourier transforms and communication theory
Microwave optics of artificial dielectric media
Microwave interferometry and the Faraday effect

Air Force Cambridge Research Center, Bedford, Mass.
THE McGILL SYMPOSIUM ON MICROWAVE OPTICS, JUNE 22-25, 1953. PART II. DIFFRACTION AND SCATTERING, by B. S. Karasik and F. J. Zucker. Apr 59, 250p. 172 refs. AFCRC-TR-118(II); AD-211 500.
Order from OTS $3.50 PB 161 451

Contents:
Electromagnetic theory
General techniques
The geometric optics limit in diffraction theory
Asymptotic developments
Diffraction by apertures
Scattering by specific bodies
Radiation patterns of antennas
Experimental studies
(See also PB 161 450)

Hughes Aircraft Co., Culver City, Calif.
NEAR FIELD ANALYSIS OF CIRCULAR APERTURE ANTENNAS, by R. C. Hansen and L. L. Bailin. Scientific rept. no. 3508/3 on Contract AF 19(604)3508. Aug 59, 37p. 20 refs. AFCRC-TN-59-780; AD-228 778.
Order from LC mi$3.00, ph$6.30 PB 144 600

The problem of the accurate determination of the total electromagnetic field produced by a current distribution on a circular disc type aperture is examined. For comparison of the near and Fresnel region solutions, an exact Maxwellian integral is used as the starting point. Aperature and space coordinates are separated by the use of Bessel function addition theorems, allowing the field to be expressed as a sum of terms containing radial and angular integrals. The radial integrals involve only the disc (aperture) distribution and coordinates while the angular integrals involve only the elevation angle. The distance from origin appears implicitly in the series coefficients. These integrals are suitable for high speed computations and have been evaluated for a number of cases. The results are compared with the small angle and general Fresnel formula values for various observation angles, distances from the aperture, and aperture distributions. (Author)

Hughes Aircraft Labs., Culver City, Calif.
PERIODICALLY SLOTTED SURFACE WAVE STRUCTURE, by Robert W. Hougardy. Scientific rept. no. 3508/4 on Contract AF 19(604)3508. Aug 59, 31p. 11 refs. AFCRC-TN-59-781.
Order from LC mi$3.00, ph$6.30 PB 144 599

A new type of surface wave structure is considered in which the required reactive surface impedance is provided by a parallel array of air-filled waveguides with contiguous broad walls. Each guide has a narrow wall containing a series of closely-spaced, nonresonant, transverse slots. For an operating frequency at which the narrow dimension of each guide is less than one-half free-space wavelength, all propagating modes are of the surface wave type. An approximate solution for the propagation constant β of the dominant mode is obtained by employing a variational technique. Experimental results are in qualitative agreement with theory. Attempts to predict the radiation pattern of this surface wave structure meet with varied success, with best results obtained for $(\beta/k)-1<0.040$. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
THE SOLUTION OF MAXWELL'S EQUATIONS IN TERMS OF A SPINOR NOTATION. PART I. THE INITIAL VALUE PROBLEM IN TERMS OF FIELD STRENGTHS AND THE INVERSE PROBLEM, by

H. E. Moses. Rept. on Contract AF 19(604)1717. June 58, 39p. 5 refs. Research rept. no. EM-114; AFCRC-TN-58-189; AD-152 441.
Order from LC mi$3.00, ph$6.30 PB 137 566

Maxwell's equations for fields with sources in media in which the dielectric constant and permeability are unity are written in terms of a spinor notation which resembles the one used for Dirac's equation for the electron. One can introduce Green's functions and expansions in terms of complete sets of orthogonal functions, which are analagous to those used in the quantum theory of the electron, to solve Maxwell's equations in more compact form than in terms of the conventional vector notation. It is possible to express both real and complex vector potentials simply in terms of the field strengths by means of this notation. Some examples will be given. Furthermore, the new notation enables us to solve in a simple way an 'inverse radiation problem'.

Institute of Optics, U. of Rochester, N. Y.
A SIMPLE PULSED ULTRAVIOLET LIGHT SOURCE, by Richard F. Weeks. Technical note no. 15 on Contract AF 19(600)193. Sep 58, 19p. 6 refs. AFOSR-TN-58-615; AD-162 143.
Order from LC mi$2.40, ph$3.30 PB 138 219

A pulsing circuit to permit the use of a conventional low pressure "Nester" hydrogen arc as an ultraviolet stimulating source for luminescence studies is described. The pulse duration may be varied from 5 milliseconds to 30 microseconds with a repetition rate of 60 per second. There is no perceptible variation of the light form from pulse to pulse. The rise time of the pulses is 20 microseconds and the fall time, 0.3 microseconds. The pulsing circuit is assembled from conventional electronic components and contains no critical high frequency circuits. The inherent spectral range and reliability of operation of the Nester lamp are maintained and the unit may be easily switched to DC operation. The use of this source in kinetics measurements is discussed briefly.

Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.
SELECTIVE REFLECTIVITY OF CRYSTALS IN THE NEAR INFRARED, by Dean Fiske Kimball. Rept. on Contract Nonr-248(01). 1 Oct 57, 87p. 9 refs. AD-200 149.
Order from LC mi$4.80, ph$13.80 PB 137 708

The reflectivities of six newly prepared synthetic crystals (corundum, spinel, nickel zinc ferrite, zinc ferrite, titania oxidized and titania reduced) were measured over the region 1-25 microns. The measurements were made on a modified Perkin-Elmer Model 12C single beam double pass spectrometer using unpolarized radiation and near normal incidence. All crystals exhibited selective reflection with the regions of strong reflection of zinc ferrite and nickel ferrite beginning at about 15 microns, and those of the other crystals beginning at about 11 microns. Corundum attained the highest reflectivity of any of the samples, its peak reflectivity reaching 95%. However, it appears that the titania crystals have the best chance of proving useful. The transmission of a plate of 0.0096" thickness of InSb was also measured over the region 1-25 microns. It was opaque out to 7 microns after which the transmission increased very rapidly to a maximum value of 45%. This material has found application as a short wavelength cut-off filter. (Author)

Research Technology Associates, Inc., Waltham, Mass.
STUDY OF ELECTRON AND ION BEAMS UNDER OUTER SPACE CONDITIONS, by J. Babakian. Final rept. on Contract AF 19(604)3895, 15 Aug 59, 97p. 17 refs. AFCRC-TR-59-172.
Order from LC mi$5.40, ph$15.30 PB 144 980

The research and design of an experimental high vacuum system is considered in some detail. This facility was intended for the evaluation of electron and ion beams under a variety of environmental conditions. The equipment has been built and tested. Some aspects of the formation and propagation of electron beams have been considered. Some designs of electron guns and their possible use have been discussed. In like manner ion sources and ion beams have been covered.

Rome Air Development Center, Griffiss AFB, N. Y.
AN INVESTIGATION WITH NEUTRAL DENSITY FILTERS OF THE RELATIONSHIP BETWEEN CRT SIGNAL DETECTION AND BRIGHTNESS DISCRIMINATION, by Robert L. Erdmann. Nov 59, 13p. 2 refs. RADC-TN-59-318.
Order from LC mi$2.40, ph$3.30 PB 144 776

Signal detectability on cathode ray tubes (CRT) depends primarily upon the brightness discrimination ability of the observer. Typical data on brightness discrimination indicates that this function improves continuously up to intensity values well above the maximum light output of a CRT. Yet, observations relating to voltage required for signal detection on CRT's to grid bias, which regulates light output, show a minimum value well below the bias that produces maximum light output. This report presents two previous explanations of this phenomenon and investigates the implications of one. The discussion section presents some special difficulties encountered when trying to apply brightness discrimination data to intensity modulated scopes. (Author)

Stanford U., Calif.
SYNTHESIS OF THIRD ORDER CONTRACTOR CONTROL SYSTEMS, by Irmgard Flügge-Lotz. Rept. on Contracts AF 49(638)513, NAw-6533, and AF 33(600)35030. 15 Oct 59, 32p. 14 refs. Div. of Engineering Mechanics technical rept. no. 123; AFOSR-TN-59-918.
Order from LC mi$3.00, ph$6.30 PB 145 504

The transfer function of the uncontrolled linear dynamic system has one real and two complex poles and may have zeros. The parameters of the system change with operating conditions. A feedback contactor control with linear switching function is suggested, which can be realized easily and which is efficient under different operating conditions. The

design is based on the idea of coming as close as possible to "optimum" control in those cases for which the latter is known. The influence of imperfections (time delay, threshold) on the performance of the control system is discussed. (Author)

Technical Research Group, Syosset, N. Y.
SPHERICALLY SYMMETRICAL LENSES, by A. F. Kay. Rept. on Contract AF 19(604)4054. Oct 58, 37p. 14 refs. Technical rept. no. 122-1; AFCRC-TN-58-566; AD-160 878.
Order from LC mi$3.00, ph$6.30 PB 138 277

A design procedure is given for finding the index variation of a spherically (or cylindrically) symmetric lens which will produce, with some restrictions, any desired shaped beam pattern. Applications are made to a broad beam Luneberg lens, a bistatic Luneberg reflector, and a bistatic Eaton-Lippmann lens. Other examples are also worked out. The practical importance of the index singularity at the center of lenses of the Eaton-Lippmann type is treated. In Part II, the question of tolerances in refractive index in spherically and cylindrically symmetric lenses is considered. Some new properties of radially symmetric lenses are given.

Trinity Coll., Dublin (Eire).
EMISSION OF SECONDARY ELECTRONS FROM SOLID SURFACES. Annual technical status rept. ATR no. 1 for 1 Nov 58-31 Oct 59 on Contract DA 91-591-EUC-973. 6 Nov 59, 5p. AD-228 543.
Order from LC mi$1.80, ph$1.80 PB 144 920

Experimental work has been concerned with the production of ultra high vacuum in the neighborhood of 10^{-10}mm Hg necessary for the production and maintenance of clean surfaces.

Molecular Physics and Spectroscopy

Columbia U., New York.
THEORY OF SATURATION IN ELECTRON SPIN RESONANCE SPECTRA, by Michael J. Stephen and George K. Fraenkel. Technical note rept. no. 2 on Research in Electron Spin Resonance, Contract AF 49(638)520. 23 Sep 59, 44p. 24 refs. CU-2-AF-520-Chem.; AFOSR-TN-59-745.
Order from LC mi$3.30, ph$7.80 PB 144 910

A theory of saturation in electron spin resonance spectra exhibiting hyperfine splitting is presented. This theory is used to study the saturation of free-radical spectra in solution, and a variety of relaxation processes are investigated.

Emory U., Ga.
RELATIVE DOUBLE-BONDING CAPACITIES OF THE HALOGENS, by J. H. Goldstein, John A. Howe and Roselin S. Wagner. Technical rept. no. 4 on Program in Microwave Spectroscopy, Contract DA 91-009-ORD-440. 15 Dec 56, 4p. 9 refs.
Order from LC mi$1.80, ph$1.80 PB 138 327

Brief based studies are made of several series of gaseous organic halides. (See also PB 137 496)

Indiana U., Bloomington.
A STROBOSCOPIC FLASH SOURCE FOR KINETIC SPECTROSCOPY, by Jerry H. Current, Odell F. Raper, and Edward J. Blair. Rept. on Contract AF 18(603)93. 29 Aug 58, 12p. 3 refs. AFOSR-TN-58-[778]; AD-201 926.
Order from LC mi$2.40, ph$3.30 PB 138 172

A stroboscopic light source is described for observing the kinetic behavior of chemical systems by absorption spectroscopy. The light consists of a short train of flashes in an accurately timed sequence. Such a system takes advantage of the brilliance of the xenon flash source while at the same time making it possible to observe the system at a sequence of times. Accurate timing is inherent in the apparatus. (Author)

Institute of Molecular Physics, U. of Maryland, College Park.
MOBILITY OF HYDROGEN IONS (H^+, H_2^+, H_3^+) IN HYDROGEN, by Edward A. Mason and Joseph T. Vanderslice. Rept. on Contract AF 18(600)1562. 14 Nov 58, 23p. 26 refs. IMP-OSR-11; AFOSR-TN-58-1005; AD-206 148.
Order from LC mi$2.70, ph$4.80 PB 137 813

Force laws for H^+, H_2^+, and H_3^+ in H_2 are calculated from theory and from results on the scattering of low-velocity ion beams in H_2 gas. These results are then used to calculate the mobilities of the hydrogen ions in H_2 gas as a function of temperature. The mobilities of H^+ and H_2^+ decrease slightly with increasing temperature, but the mobility of H_3^+ increases strongly. The agreement with experiment indicates that the unidentified hydrogen ion whose mobility has been measured is probably H_2^+, rather than the usually assumed H_3^+. (Author)

Massachusetts Inst. of Tech., Cambridge.
SOLID-STATE AND MOLECULAR THEORY GROUP. Quarterly progress rept. no. 28 on Contract Nonr-1841(34). 15 Apr 58, 66p. 75 refs. AD-161 845.
Order from LC mi$3.90, ph$10.80 PB 138 568

A note on the spin hamiltonian
Compton scattering of X-rays from non-spherical charge distributions
X-ray atomic scattering factors
Electronic wave functions for polyatomic molecules
Dipole moment in hydrogen fluoride
Electron coupled interaction between nuclear spins in the HD molecule
Multi-center integral programs for I. B. M. 704 computer
704 programs
Energy band in iron
Energy bands in potassium
Bimolecular semiconducting compounds
Electronic structure of a two-vacancy V-center in KCl
Interaction of a hole with mobile lattice ions in KCl
Transport properties of metals (See also PB 138 444)

Mellon Inst. [of Industrial Research, U. of Pittsburgh] Pa.
INFRARED SPECTROSCOPIC EVIDENCE FOR THE ROTATION OF AMMONIA MOLECULE IN SOLID ARGON AND NITROGEN, by D. E. Milligan and R. M. Hexter. Rept. on Contract AF 49(638)542. 18 Dec 59, 16p. 6 refs. AFOSR-TN-59-1327.
Order from LC mi$2.40, ph$3.30 PB 144 908

High resolution infrared spectra [of the symmetric bending mode] of ammonia suspended at high dilution in solid argon and nitrogen have been obtained. More than a half dozen extremely sharp bands have been observed in the 950-1040 cm^{-1} region [in the spectrum of ammonia] in these materials under conditions where there should be little if any absorption due to polymeric species. The frequency separations of the bands, their temperature dependence and their extreme sharpness appear to be compatible with a model in which the ammonia molecule executes quantized rotation in these solids. (Author)

Mellon Inst. [of Industrial Research, U. of] Pittsburgh, Pa.
INTERMOLECULAR COUPLING OF VIBRATIONS IN MOLECULAR CRYSTALS, by R. M. Hexter. Rept. on Contract AF 49(638)542. 22 Oct 59, 36p. 25 refs. AFOSR-TN-59-1139.
Order from LC mi$3.00, ph$6.30 PB 144 867

The theory of Davydov of the origin of correlation field splittings is applied to the non-degenerate modes of solid methyl chloride. Intermolecular coupling constants and dipole derivatives for these modes in the solid are derived. An isotope effect on such splittings is reported for the first time in methyl iodide and is accounted for by means of Davydov's theory. The effect of intermolecular transition dipole coupling on intensities is derived and compared with implications of the dipole derivatives derived from the correlation field splittings. The possible use of other bases for correlation field splittings is discussed. (Author)

University Coll., Dublin (Eire).
OPTICAL ABSORPTION IN INORGANIC SOLIDS. Annual Technical rept. no. 1, 1 Oct 58-30 Oct 59, on Contract DA 91-591-EUC-958. 30 Oct 59, 13p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 145 019

The absorption spectra of thin films of stannous oxide, stannic oxide, tetragonal plumbous oxide, rhombic plumbous oxide and plumbic oxide have been determined from 2000 - 10,000A. The absorption spectra of thin films of beryllium oxide zirconium dioxide, tantalum pentoxide, stannous oxide, stannic oxide, plumbous oxide, arsenic trioxide, antimony trioxide and bismuth trioxide have been determined from 1200 - 2000A using a Schumann region grating spectrophotometer. Another apparatus for evaporation in vacuum and an apparatus for the measurement of absorption spectra at liquid nitrogen temperatures have been constructed during the reporting period.

Air Force Missile Development Center, Holloman AFB, N. Mex.
A STUDY OF THE REFLECTION EFFICIENCIES OF A WATER-WHITE, SILVER-BACKED GLASS MIRROR AT DIFFERENT ANGLES OF INCIDENCE, by Fred Allison and Kenneth Steele. Oct 59, 62p. AFMDC-TN-59-27.
Order from LC mi$3.90, ph$10.80 PB 144 979

The reflection efficiencies of the silver-backed, water-white glass mirror contemplated for the Holloman Solar Furnace have been determined, at various angles of incidence, by both computational and experimental methods. The results indicate practically negligible differences in the mirror efficiencies at all angles at which the solar radiation will impinge on the heliostat and the condenser mirrors of the presently designed furnace. The mirror efficiency experimentally determined approximates 92 percent of the incident angles considered. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
POWER SPECTRA EVALUATIONS FOR SELECTED AIRBORNE MICROWAVE REFRACTOMETER RECORDINGS, by F. N. Edmonds, Jr., F. X. Bostick, Jr. and J. R. Gerhardt. Rept. on Contract AF 19(604)2249. 15 Aug 58, 88p. 22 refs. Rept. no. 6-24; AFCRC-TN-58-377; AD-160 830.
Order from LC mi$4.80, ph$13.80 PB 138 256

Fifteen samples of tropospheric index of refraction fluctuations have been analyzed statistically to give a description of the fluctuation field which is then interpreted in terms of current theories for the production of these fluctuations. The samples or shots were measured with an airborne microwave refractometer over Camp Carson, Colorado, at altitudes ranging from 6500 to 20,000 feet above mean sea level. The analysis used improved equipment and techniques developed at EERL and yielded a power spectrum, an amplitude distribution plot and a running rms for each sample which are presented in Appendix I.

Millikan Lab. of Physics, Pomona Coll., Claremont, Calif.
ULTRASOFT X-RAY INTERACTION COEFFICIENTS, by Burton L. Henke and Jack C. Miller. Technical rept. no. 3 on Ultrasoft X-ray Physics, Contract AF 49(638)394. Aug 59, 84p. 8 refs. AFOSR-TN-59-895.
Order from LC mi$4.80, ph$13.80 PB 144 965

Ultrasoft x-radiations (10 to 100 A in wavelength) are highly absorbed by matter so as to be particularly useful in microanalysis. Not only are the photoelectric absorption cross-sections very large compared with those for conventional x-ray wavelengths but also the effect of radiative damping upon the scattered wave becomes significantly large. Generally, the ultrasoft x-ray interactions are considerably simpler and more easily defined than those for conventional x-radiations. Atomic scattering factors have been tabulated for O, Al and Si; refractive indices have

been obtained for Al, Al_2O_3, and SiO_2; and the reflected intensities from surfaces of Al, Al_2O_3 and SiO_2 and from layered combinations of these surfaces have been tabulated as a function of both wavelength and angle of reflection. These results have been used to illustrate the potentiality of ultrasoft x-radiations for application to the microanalysis for mass, chemical and surface structure information.

Naval Ordnance Test Station, China Lake, Calif.
THE SPATIAL DISTRIBUTION OF INFRARED RADIATION FROM THE CLEAR SKY INCLUDING SEQUENCES OF SKY MAPS AT VARIOUS ELEVATIONS, by H. E. Bennett, Jean M. Bennett, and Max R. Nagel (Air Force Cambridge Research Center). 30 Sep 59, 72p. 21 refs. NOTS Technical pub. 2302; NAVORD rept. 6577.
Order from LC mi$4.50, ph$12.30 PB 145 109

Series of measurements of the spatial distribution of radiation from the clear sky made from locations at approximately 1000, 6000 and 14,000 feet elevation are reported. A theoretical relation is shown to correctly predict the observed variation in radiance with elevation angle in the 2-40 micron wavelength region, where radiation from the sky is mainly due to thermal emission by the atmosphere. In the 0.6-2 micron region, where the radiation is mainly scattered sunlight, the spatial distribution is related to that which was observed simultaneously in the visible but forward scattering is relatively more important in the near infrared and the relative intensities in the two regions are not constant. (Author)

New York U., N. Y.
A STUDY OF THE FAR INFRARED PROPERTIES OF CRYSTALS, by J. H. Rohrbaugh. Scientific rept. no. 7, 1 Mar-31 May 59, on Millimeter Wave Project, Contract AF 19(604)2673. [1959] 71p. 4 refs. AFCRC-TN-59-784.
Order from LC mi$4.50, ph$12.30 PB 144 969

A perturbation method is described whereby the eigenfrequencies and the frequency distribution of an alkali halide may be calculated at an arbitrary temperature if this has been done at room temperature. This is applied here to find the eigenfrequencies of NaCl at 2°K, and to compare with the values at room temperature. A method is also presented for the calculation of the perturbed eigenvectors and several are calculated and examined. Results are given for the experiment investigating the effect of surface conductivity on the intensity distribution among the orders of an echelette grating. The findings are inconclusive. (Author) (See also PB 142 729)

Polan Industries, Inc., Huntington, W. Va.
INDUSTRIAL PREPAREDNESS STUDY FOR NEAR INFRARED FILTERS AND INTERMEDIATE INFRARED FILTERS, by D. N. Igou. Final rept. for 26 June 56-May 59 on Contract DA 36-039-sc-72739. May 59, 69p. 14 refs.
Order from LC mi$3.90, ph$10.80 PB 145 441

This report includes data on quarters, equipment, materials, methods and procedures used in manufacturing these filters. It also includes Near and Intermediate Infrared Filter Curves, photographs and drawings of equipment and facilities necessary for production. (Author)

Woods Hole Oceanographic Institution, Mass.
MEASUREMENT OF SPECTRAL DISTRIBUTION OF LIGHT UNDERWATER, by Charles J. Hubbard. Status rept. on Research in Underwater Optics, Contract Nonr-1720(00). Jan 58, 15p. Ref. no. 58-6; AD-154 363.
Order from LC mi$2.40, ph$3.30 PB 137 955

The optical system of the spectrophotometer swept the wavelength region from 4000 A to 6000 A with a bandwidth of about 100 A. The instrument was designed to be suspended by 4-conductor oil well logging cable. The detecting element of the instrument was a type 1P21 multiplier phototube. The optical system employed was a variation of the Littrow spectrometer in which the collimated light is passed twice through the dispersing prism. Included in the pressure case was a depth measuring element which consisted of a commercial pressure actuated potentiometer. A Sanborn 2-channel type recorder was used. The calibration of wavelength versus elapsed time, relative to the pulse from the depth meter was obtained by means of several gas discharge tubes of known emission line spectra. Eight successful lowerings of the spectrophotometer were made in the Atlantic slope water.

Solid State Physics

[Arkansas U., Fayetteville]
PHOTOLYSIS OF CRYSTALLIZED LEAD AZIDE, by Jack G. Dodd, Jr. [Rept. on Contract DA 44-009-eng-2439] 15 Aug 56, 73p. 49 refs. AD-124 250.
Order from LC mi$4.50, ph$12.30 PB 137 723

The photolysis of lead azide in the crystalline form has been studied as a function of wave length, intensity and time, and the results indicate that the mechanism of photolysis suggested by Thomas and Tompkins (Proc. Roy. Soc. 209A:550-561, 1951; 210A:111-125, 1951) for barium and potassium azides cannot apply without modification. It is shown that an unusual lattice contribution exists for lead azide by comparing the photolytic threshold of lead azide in solution with lead azide in the crystalline state. On the basis of this information a model involving the production, trapping, and subsequent decomposition of single excitons at, or near, the surface is proposed. This model requires the production of holes and F-centers, the holes at least to be mobile. The presence of F-centers is believed to have been demonstrated through photoemission studies in which two regions of photosensitivity are observed; one due to direct ionization of the F-center by the incident radiation, and the other to ionization of the F-center by excitons formed during photolysis. Some unexplained results indicating that the photolytic rate varies as some small power of the time are presented, and it is shown that simple diffusion theory applied to the escape of nitro-

gen from the interior of the crystal is inadequate to fit the data. Some sort of recombination between F-centers and holes is suggested. (Author)

Brown U. Div. of Engineering, Providence, R. I.
ON THE STEADY CREEP OF SHELLS, by E. T. Onat and H. Yuksel. Technical rept. no. 5 on Contract Nonr-562(20). Jan 58, 19p. 7 refs. AD-154 573.
Order from LC mi$2.40, ph$3.30 PB 137 916

The analysis of the steady creep deformations is usually based on the creep law which stipulates the proportionality of the strain rate tensor to the tensor of stress deviation, the proportionality factor being a function of the invariants of the deviatoric stress tensor. Wahl (J. Applied Mech. 23:231-238, 1956) suggested a modified law which is related to the Tresca's yield criterion of the theory of plasticity. The modified creep law which is particularly suitable for the investigation of rotationally symmetrical deformations of shells is discussed in geometrical terms. The modified law is applied to establish the creep behavior of a sandwich cylindrical shell in terms of the stress resultants and the rates of curvature and extension of the middle surface. An example is treated using the stress resultants and the deflection rates as relevant variables to show the simplifications achieved in the analysis. Finite deflections of a solid circular membrane under uniform pressure are also discussed as a further example of the modified creep law.

California U., Los Angeles.
YIELD SURFACE AND PLASTIC POTENTIAL OF METALS, by T. H. Lin. Rept. on Contract AF 49(638)20. July 59, 13p. 30 refs. AFOSR-TN-59-714.
Order from LC mi$2.40, ph$3.30 PB 144 931

The coincidence of the plastic potential and yield surface for both single crystal and polycrystal aggregate is derived from the consideration of elastic strain and slips in individual crystals. Uniqueness in single crystals for incremental stress and strain is discussed. Corners in yield surfaces of a polycrystal aggregate are shown to exist and the sharpness of the corner is shown to increase with loading. (Author)

Chicago Midway Labs., U. of Chicago, Ill.
PREPARATION AND PROPERTIES OF INDIUM ARSENIDE, by Roy H. Harada and Alan J. Strauss. Rept. on Contract AF 18(603)09. 31 July 58, 28p. 17 refs. CML-TN-P108-14; AFOSR-TN-58-[742; AD-202 311]
Order from LC mi$2.70, ph$4.80 PB 137 689

Arsenic prepared by reduction of arsenic trichloride and purified by a thermal gradient sublimation technique has been used to prepare zone-refined n-type InAs as pure as any previously reported, although its free carrier concentration is still somewhat greater than 10^{16} cm^{-3}. A horizontal modification of the Bridgman technique has been used to grow large single crystals of InAs. The results of electrical measurements on the n-type material are in good agreement with those obtained elsewhere. These results, together with the results of heat treatment experiments performed at the Naval Ordnance Laboratory, support the view that the free carriers in the InAs are produced by ionization of doner impurities (principally sulfur) which originate in the arsenic used for synthesis. Compensated samples of InAs have been prepared by doping with cadmium. One such sample exhibits anomalous electrical properties similar to those reported in the literature for samples doped with zinc. Another cadmium-doped sample has a resistivity of 80 ohm-cm at 77°K, by far the highest value ever reported for InAs. (Author)

Detroit U. Mich.
DEVELOPMENT OF A MATHEMATICAL THEORY OF PLASTICITY BASED ON THE CONCEPT OF SLIP, by H. Payne, S. J. Czyzak, and N. Bow. Rept. on Contract AF 18(600)1466. 1 Oct 59, 25p. 8 refs. AFOSR-TN-59-1030.
Order from LC mi$2.70, ph$4.80 PB 144 773

The model developed by H. Payne has been used to solve the problem of a thin wall cylinder which is subjected to a torsional strain following a plaster tensile strain and the results of this work are described in detail. The study of the Bauschinger effect has been started and the work contained in this report deals with the first phase of this study. The method for calculating the plastic behavior for a reversal of a uniaxial strain has been developed and is discussed. (Author) (See also PB 140 791)

Diamond Ordnance Fuze Labs., Washington, D. C.
MICROWAVE PROPERTIES OF YTTRIUM IRON GARNET, by E. G. Spencer, R. C. LeCraw and C. S. Porter. 30 June 59, 18p. 21 refs. TR-633; AD-205 261.
Order from LC mi$2.40, ph$3.30 PB 145 010

Single crystal yttrium iron garnets grown from lead monoxide solution have the narrowest ferromagnetic resonance line widths of any material yet reported. Measurements, on spheres, are described of line width, threshold field, and relaxation times. These properties are shown to be strongly dependent on the degree of polish of the specimen surface.

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 1, 1 June-31 Aug 51, on Contract DA 36-039-sc-5587. [1951] 23p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 138 065

Eucryptite $LiAlSiO_4$ was grown in this quarter in fairly large fragments from melts of its own composition giving rise to the possibility that crystals of sufficient size for piezoelectric tests can be grown by one or more of the fusion methods such as slow cooling or lowering of a melt through a thermal gradient.

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 3, 1 Dec 51-29 Feb 52, on Contract DA 36-039-sc-5587. [1952] 19p. 14 refs.
Order from LC mi$2.40, ph$3.30 PB 138 066

Although crystals of eucryptite can be grown by slow cooling of melts of the composition $LiAlSiO_4$, nevertheless some measures must be taken to prevent spontaneous nucleation at many points. A special furnace has been constructed as well as apparatus for lowering the desired melt through the selected region of the gradient of the furnace. (See also PB 138 065)

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 4, 1 Mar-31 May 52, on Contract DA 36-039-sc-5587. [1952] 17p.
Order from LC mi$2.40, ph$3.30 PB 138 067

Crystallographic evaluation of the compounds covered in the comprehensive survey on "The Stuffed Derivatives of the Silica Structures" as piezoelectric materials is included in this report. The most promising compounds are those listed under high tridymite and eucryptite. (See also PB 138 066)

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 7, 1 Dec 52-28 Feb 53, on Contract DA 36-039-sc-5587. [1953] 17p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 138 068

Microscopic examination revealed the precipitation of impurities within the crystals of eucryptite. Melts of $LiAlSiO_4$ are rather viscous at about 1430°C. thereby reducing the possibility of successful growth of eucryptite by the withdrawal technique. (See also PB 138 067)

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 9, 1 June-31 Aug 53, on Contract DA 36-039-sc-5587. [1953] 17p.
Order from LC mi$2.40, ph$3.30 PB 138 069

One objective during this quarter was to obtain more of the two unidentified crystalline phases which were discovered while evaluating graphite as a crucible material in runs made at 1450°C. to 1725°C. A rather long needle-like crystal was grown. The needle-like crystals as well as the hexagonal plates have been tentatively identified as corundum by optical and x-ray means. The optimum temperature for growth of corundum under the conditions described in this report is approximately 1700°C. (See also PB 138 068)

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 10, 1 Sep-30 Nov 53, on Contract DA 36-039-sc-5587. [1953] 14p.
Order from LC mi$2.40, ph$3.30 PB 138 070

Large eucryptite crystals were produced by slow cooling melts of $LiAlSiO_4$ composition from about 1390°C. to 1350°C. The dendritic growth encountered in these melts is believed to be due to the presence of impurities in the starting materials. (See also PB 138 069)

Edward Washken Labs., Cambridge, Mass.
STUDY OF SILICA STRUCTURE MINERALS, by Edward Washken. Quarterly interim rept. no. 11, 1 Dec 53-28 Feb 54, on Contract DA 36-039-sc-5587. [1954] 17p. 1 ref.
Order from LC mi$2.40, ph$3.30 PB 138 071

Crystals obtained as a result of the slow cooling of melts of the composition $KNa_3Al_4Si_4O_{16}$ were small. It is believed that the high viscosity of the melt inhibits the formation and growth of large crystals. (See also PB 138 070)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
STRUCTURE-DETERMINED PROPERTIES OF EVAPORATED BISMUTH FILMS, by Carl E. Drumheller. Final technical rept. on Contract AF 33(028)21255. 15 Apr 58, 27p. 2 refs. AFOSR-TR-58-57; AD-154 280.
Order from LC mi$2.70, ph$4.80 PB 138 059

Infrared and electrical studies were made on bismuth films evaporated at 10^{-5} mm pressure onto cellulose nitrate substrates. To about 2000 Å thickness the films possess a single-layer polycrystalline structure. The infrared studies indicate that there are two types of grain boundaries, namely, those which contribute to the conductivity and those which do not.

Harshaw Chemical Co., Cleveland, Ohio
PREPARATION OF OPTICAL THALLIUM HALIDES, by H. C. Kremers. Rept. on Contract NObs-28277. [1946] 5p.
Order from LC mi$1.80, ph$1.80 PB 137 807

Covers purification as well as preparation. Melting points are given. Cutting techniques for the crystals are briefly noted.

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE AND OPTICAL SPECTRA OF SINGLE CRYSTAL OXIDES CONTAINING PARAMAGNETIC IMPURITIES, by W. Low. Technical note no. 3 on Contract AF 61(052)59. July 58, 39p. 28 refs. AFOSR-TN-58-882; AD-203 906.
Order from LC mi$3.00, ph$6.30 PB 145 401

A summary of the results of paramagnetic resonance spectra and optical spectra of single crystal oxides of cubic and lower symmetries containing paramagnetic impurities is presented. These results are discussed with reference to the possibility of using these materials for microwave amplification, Maser appli-

cations. A discussion of the effect of the Jahn-Teller theorem and the effects of covalent bonding on these spectra is given. (Author)

Illinois U., Urbana.
CONFIGURATION INTERACTION IN ALKALI HALIDE PHOSPHORS, by Robert S. Knox. Rept. on Contracts AF 18(600)689 and Nonr-1834(12). 15 Feb 59, 61p. 53 refs. [AFOSR-TN-59-232; AD-211 845]
Order from LC mi$3.90, ph$10.80 PB 144 892

It is shown that excited state wave functions of free activator ions do not provide a completely adequate basis for a quantitative theory of the luminescence of alkali halides activated by heavy metals. It is proposed that better zero-order wave functions may be obtained by allowing interaction between different types of states of excitation, and as a practical example of an electronic configuration which can interact with excited activator configurations, the electron transfer states of the Seitz model are discussed in detail.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
DISPERSION RELATIONS AND VIBRATIONAL FREQUENCY SPECTRA, by A. A. Maradudin and G. H. Weiss. Rept. on Contract AF 18(600)1315. Oct 59, 12p. 11 refs. Technical note BN-187; AFOSR-TN-59-1104.
Order from LC mi$2.40, ph$3.30 PB 144 782

Many relations have been given connecting the dispersion relation and frequency spectrum for a vibrating lattice. It is the purpose of this paper to show that these relations can all be derived from a single integral representation by using different representations of the delta functions. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE ELECTRONIC GROUND STATE OF AN APERIODIC ONE-DIMENSIONAL DELTA-FUNCTION LATTICE, by Alexei A. Maradudin and Barry S. Gourary (Applied Physics Lab.). Rept. on Contracts AF 18(600)1315 and NOrd-7386. Nov 59, 6p. 1 refs. Technical note BN-189; AFOSR-TN-59-1191.
Order from LC mi$1.80, ph$1.80 PB 145 314

Institute for the Study of Metals, U. of Chicago, Ill.
SELF-DIFFUSION IN SILVER DURING PLASTIC DEFORMATION IN EXTENSION AND COMPRESSION, by J. B. Darby, Jr. C. T. Tomizuka, and R. W. Balluffi. Rept. on Contract AF 18(600)1489. 14 Nov 58, 35p. 21 refs. AFOSR-TN-58-941; AD-205 085.
Order from LC mi$3.00, ph$6.30 PB 137 841

Self-diffusion of Ag^{110} in silver single crystals subjected to simultaneous deformation at 800 and 900°C. was studied using the sectioning technique. The effect of straining on the rate of diffusion was found to be less than 50 percent. Increases in diffusion rate due to the generation of point defects or short circuiting paths during deformation were small.

Institute of Optics, U. of Rochester, N. Y.
HOST SENSITIZED LUMINESCENCE IN KI:Tl, by K. Teegarden. Technical note B 2 on Contract AF 49(638)433. 17 Nov 58, 11p. 6 refs. AFOSR-TN-58-917; AD-204 563.
Order from LC mi$2.40, ph$3.30 PB 138 146

Host sensitized luminescence has been observed in a single crystal of KI doped with about one part in 10^5 of thallium. Excitation and emission spectra for the room-temperature luminescence are given.

Massachusetts U., Amherst.
THE SCATTERING OF LIGHT BY SPHERES WITH RADIAL VARIATIONS IN POLARIZABILITY AND ORIENTATION, by Richard S. Stein. Technical rept. no. 9 on Contract Nonr-2151(00). 10 Feb 59, 32p. 19 refs. AD-213 455.
Order from LC mi$3.00, ph$6.30 PB 144 959

In previous publications experimental results and analysis of scattering from polyethylene films are reported. The date is interpreted in a phenomonological way rather than in terms of a specific structural model. Recent experimental results have indicated that scattering data might be interpreted in terms of a ringed spherulite type model. Theoretical examination of the scattering expected from ringed spherulites has been started. This report represents the contribution of the writer to this work. More extensive calculations are being made by the Monsanto group using IBM computors.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A HIGH TEMPERATURE X-RAY DIFFRACTOMETER SPECIMEN MOUNT, by William L. Baun. Rept. for Jan-Dec 58 on Materials Analysis and Evaluation Techniques. Oct 59, 18p. 4 refs. WADC Technical note 59-139.
Order from OTS $0.50 PB 161 360

This specimen mount makes possible the examination of materials at temperatures up to 1900°C in high vacuum or inert atmosphere. Diffraction patterns of crystalline materials may be recorded in the scanning range 17° to 122° using this specimen mount. Realignment of the sample at temperature may be accomplished from each point of the three point sample suspension system. A power regulator is described which permits automatic temperature regulation by means of a sensing device that maintains an accurate pre-set temperature. (Author)

Minnesota U., Minneapolis.
NATURAL AND INDUCED SPECTRA OF SOME FERRITES, by D. B. Bonstrom, J. P. Hanton, and A. H. Morrish. Rept. on Contract AF 18(603)113. Nov 59, 35p. 12 refs. AFOSR-TN-59-1128.
Order from LC mi$3.00, ph$6.30 PB 144 868

Two ferrite materials, magnetite (Fe_3O_4) and gamma ferric oxide (γ-Fe_2O_3) have been investigated in detail over the frequency range 0 - 10 kmc/sec. These materials were in the form of powders that contained acicular particles close to the single-domain size. Detailed investigations of some single crystals of magnetite at temperatures from 2 - 125°K have been carried out. Further work on non-stoichiometric samples of magnetite is in progress.

Northwestern U., Evanston, Ill.
DEFORMATION OF SINGLE CRYSTALS CONTAINING GUINIER-PRESTON ZONES, by A. Kelly. Rept. on Contract AF 18(600)1468. 30 Dec 58, 30p. 27 refs. AFOSR-TN-58-1083; AD-207 530.
Order from LC mi$2.70, ph$4.80 PB 144 852

This paper is based on a review lecture which was given at the Physical Society Conference on Internal Surfaces at the University of Cambridge, England, in December, 1958.

Pennsylvania State U., University Park.
DEVELOPMENT AND APPLICATION OF INSTRUMENTATION FOR X-RAY AND NEUTRON ANALYSIS, by Ray Pepinsky. Final rept. on Contract DA 36-061-ORD-565. 20 May 58, 25p. OOR rept. 1797.1; AD-201 340.
Order from LC mi$2.70, ph$4.80 PB 144 756

With the rapid advance of automatic computing techniques for the treatment of diffraction data and determination and refinement of approximate crystal structures, the problems of rapid and accurate acquisition of diffraction data, experimental information about morphology, measurement of physical properties of crystals, etc., assume correspondingly greater and greater importance. Under the present research contract a variety of instruments for these purposes have been developed and constructed. Results obtained during fourteen months' operation are outlined: more detailed information on some points may be had by referring to preceding quarterly status reports, and to technical reports and published papers. Some reports and papers are yet to be prepared.

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON DIFFUSED SEMICONDUCTOR DEVICES. Quarterly progress rept. no. 3, 1 Nov 57-31 Jan 58, on Contract DA 36-039-sc-72705. [1958] 111p. Philco H-2761; AD-202 532.
Order from LC mi$6.00, ph$18.30 PB 145 445

Fabrication process of the 4.3 mc silicon, graded-base amplifying transistor. Problems encountered in the operations of diffusion, tab soldering, control of the prealloying base width, plating and high temperature whisker soldering in regard to the 4.3 mc silicon graded-base device. (See also PB 138 100)

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON DIFFUSED SEMICONDUCTOR DEVICES. Quarterly progress rept. no. 4, 1 Feb-30 Apr 58, on Contract DA 36-039-sc-72705. [1958] 111p. Philco no. H-2761; AD-204 256.
Order from LC mi$6.00, ph$18.30 PB 145 449

Germanium Program: Arsenic has replaced phosphorus as the diffusant for the germanium devices making possible a 100% increase in the output of diffused germanium blanks. Electrolytic clean-up etching has been instituted into the fabrication process with an impressive improvement in the surface condition of the unit, resulting in a much higher life expectancy characteristic. Silicon Program: A redesign of the boron diffusion furnace and a stringent program of cleanliness has virtually eliminated any surface problems and has decreased the length of time involved in the silicon diffusion by 65%. A one-step gold-phosphorus plating solution is being developed. Sealing the silicon graded-base devices in a dry nitrogen atmosphere, rather than in air, produces units having demonstrably superior electrical characteristics. (See also PB 145 445)

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON DIFFUSED SEMICONDUCTOR DEVICES. Quarterly progress rept. no. 5, 1 May-31 July 58, on Contract DA 36-039-sc-72705. [1958] 125p. 1 ref. Philco no. H-2761; AD-211 951.
Order from LC mi$6.30, ph$19.80 PB 145 447

Germanium: The problem of solution cavities and their degrading effects on the storage life of germanium transistors has now been almost completely eliminated by the use of tin-indium solder and electrolytic clean-up etching techniques. An electrolytic etching machine has been developed and the use of this machine has resulted in a much higher degree of reproducibility and a greater yield. Silicon: The technique of obtaining a high temperature whisker to electrode bond through the use of a gold whisker wire, without solder, is now in full application. It now appears that the most consistent method of obtaining reproducible injection in the silicon surface-alloy, diffused-base transistors is by adding antimony to the electrode through a second plating cycle. (See also PB 145 449)

Philco Corp., Philadelphia, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON DIFFUSED SEMICONDUCTOR DEVICES. Quarterly progress rept. no. 6, 1 Aug-31 Oct 58; on Contract DA 36-039-sc-72705. [1958] 126p. Philco no. H-2761; AD-211 952.
Order from LC mi$6.30, ph$19.80 PB 145 448

Germanium Devices: Accurate control of the depth of etching on the MADT blank was achieved through the introduction of a method of individually measuring the thickness of each blank and computing the etch time with a calculating machine. Investigations into the origin of the defect responsible for recent fatigue testing failures showed that an HF etch of the stem prior to sealing will correct the difficulty. Silicon Devices: A reduction in shrinkage losses has been effected through the modification of the alloying furnace and the replacement of the bar heater type of blank-to-tab soldering fixture with a two-probe tabbing fixture. (See also PB 145 447)

Willow Run Labs., U. of Michigan, Ann Arbor.
LIQUID HELIUM DEWAR FLASK WITH INCORPORATED MAGNET POLE TIPS, by David F. Edwards. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Nov 58, 11p. 4 refs. 2144-349-T; AD-206 297.
Order from LC mi$2.40, ph$3.30 PB 145 121

A special liquid helium dewar flask that incorporates magnet pole tips in the dewar wall has been constructed in our laboratory. This dewar permits the study of the effect of large magnetic fields on the absorption properties of semiconductors, Hall effect, and magneto-resistance. Magnetic fields greater than 30 kilogauss have been obtained with this special dewar. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
OPTICAL EFFECTS ON F-CENTER SPIN RESONANCE AT LOW TEMPERATURES, by John Lambe and John Baker. Memo. on Proj. Michigan, Contract DA 36-039-sc-78801. Nov 59, 9p. 2 refs. Rept. no. 2900-104-R; AD-228 201.
Order from LC mi$1.80, ph$1.80 PB 144 734

Because of possible maser applications, the interaction of light with spin systems is of considerable interest. In this connection, experiments were carried out to study the effect of light on the spin resonance of F-centers. These experiments were done at liquid-helium temperatures, since at this temperature the F-center has a long spin-lattice relaxation time. It was found that the spin population could be significantly affected by optical illumination. It is possible that such an effect could be useful in pumping a 3-level maser system from an optically heated 2-level spin system. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
SPIN RESONANCE OF V^{2+}, V^{3+}, V^{4+}, IN α-Al_2O_3, by John Lambe and Chihiro Kikuchi. Technical memo. on Contract DA 36-039-sc-78801. Nov 59, 32p. 30 refs. 2616-12-R; AFOSR-TN-59-922.
Order from LC mi$3.00, ph$6.30 PB 144 569

Divalent vanadium has properties similar to those of trivalent chromium in sapphire, which has wide application in masers. Because of its readily recognizable spin-resonance signature due to its nuclear spin, and because of the ease of producing different oxidation states, it is suggested that vanadium may be a suitable probe with which to study ionization effects in certain solids.

X-Ray and Crystal Analysis Lab., Pennsylvania State U., University Park.
CRYSTAL STRUCTURE RESEARCH BY X-RAY AND NEUTRON DIFFRACTION, by Ray Pepinsky. Final rept. for 1 June 54-31 May 57 on Contract DA 36-039-sc-63233. [1957] 79p. 36 refs. AD-207 990.
Order from LC mi$4.50, ph$12.30 PB 145 204

Research on the structure of ammonium substituted Rochelle salt produced definite evidence of preferential substitution on the K_1 sites, and some indication of remarkable vibrational anisotropy of the K_1. An extensive series of observations of the thermal, dielectric, and optical properties of the langbeinite type ferroelectric, $(NH_4)_2Cd_2(SO_4)_3$, and several other recently discovered ferroelectrics was completed. The transition in $(NH_4)_2Cd_2(SO_4)_3$ is judged to be first order but of a very unusual type. Ferroelectric behavior has been demonstrated in ammonium monochloracetate below -150°C.

Theoretical Physics

Cornell U. Graduate School of Aeronautical Engineering, Ithaca, N. Y.
AN INVISCID BOUNDARY LAYER OF MAGNETOHYDRODYNAMICS, by William S. Lewellen. Rept. on Contract AF 18(600)1523. Sep 59, 51p. 5 refs. AFOSR-TN-59-927.
Order from LC mi$3.60, ph$9.30 PB 144 767

A boundary-layer approximation for fluids with large electrical conductivities is applied to the two-dimensional, steady, inviscid, incompressible magnetohydrodynamic equations for the case of a uniform magnetic field parallel to the free stream. Two approaches to the solution of the magnetic boundary layer are used. In the first, the approximate integral method is used to derive equations analogous to the von Kármán integral momentum equation of viscous theory. These equations are integrated for flow of the type $\mu_1 = C \times \eta$. In the second approach the exact magnetic-boundary-layer equations are transformed, for similar flows, into a system of ordinary differential equations. The solution of these equations is found in the form of a power-series expansion in a parameter equal to the Alfvén speed divided by the free-stream velocity. Numerical results are given for several cases of similar flow. In sub-Alfvénic flow evidence points to a boundary layer growing in the direction opposite to the flow. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
THE FIELD INDUCED BY A MAGNETIC POLE APPROACHING A PLATE OF FINITE CONDUCTIVITY AND THICKNESS, by Chester Snow. 30 Sep 59, 128p. Technical rept. TR-447.
Order from LC mi$6.30, ph$19.80 PB 145 271

This analysis deals with the problem of a magnetic pole approaching an infinite plate; the author has solved the quasistatic problem for the field of induced eddy currents in the general case where the sheet has arbitrary thickness and arbitrary conductivity. Maxwell's result for thin sheets is seen to be a limiting case in which the thickness approaches zero and the conductivity approaches infinity with their product being finite. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
SMALL PERTURBATIONS IN HYDROMAGNETICS, FREE OSCILLATIONS IN A RECTANGULAR BOX, AND THE PERFECTLY CONDUCTING GAS, by G. S. S. Ludford. Rept. on Contract AF 49(638)154. July 58, 26p. 5 refs. Technical rept. BN-143; AFOSR-TN-58-700; AD-162 234.
Order from LC mi$2.70, ph$4.80 PB 137 690

This paper treats the small perturbations of an electrically conducting inviscid gas in the presence of a uniform undisturbed magnetic field. In particular the free oscillations in a rectangular box are determined and used to examine the limit of infinite conductivity. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
ON EXPERIMENTAL TESTS OF THE GENERAL THEORY OF RELATIVITY, by L. I. Schiff. Technical note no. 7 on Contract AF 49(638)388. Sep 59, 14p. 4 refs. AFOSR-TN-59-1020.
Order from LC mi$2.40, ph$3.30 PB 144 774

This paper explores the extent to which the three "crucial tests" support the full structure of the general theory of relativity, and do not merely verify the equivalence principle and the special theory of relativity, which are well-established by other experimental evidence. It is shown how the first-order changes in the periods of identically-constructed clocks and the lengths of identically-constructed measuring rods can be found without using general relativity, and how the red shift and the deflection of light can be computed from them. Only the planetary orbit precession provides a real test of general relativity. Terrestrial or satellite experiments that would go beyond supplying corroborative evidence for the equivalence principle and special relativity would be extremely difficult to perform, and would for example require a frequency standard with an accuracy somewhat better than one part in 10^{18}. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
SPECTRAL REPRESENTATIONS OF GREEN'S FUNCTIONS IN PERTURBATION THEORY, by J. D. Bjorken (Doctoral thesis). Technical note no. 4 on Contract AF 49(638)388. Sep 59, 43p. 11 refs. AFOSR-TN-59-948.
Order from LC mi$3.30, ph$7.80 PB 144 764

Microwave Lab., Stanford U., Calif.
INVESTIGATION OF MICROWAVE PROPERTIES OF PLASMAS, by M. Chodorow. Scientific rept. no. 2, 1 Feb-30 July 59, on Contract AF 19(604)5226. Oct 59, 16p. M. L. rept. no. 647; AFCRC-TN-59-796.
Order from LC mi$2.40, ph$3.30 PB 144 927

A convenient way to produce a plasma in the laboratory is by means of an arc discharge. This type of plasma has disadvantages. A new type of plasma will be produced and its properties studied. (Author)

Naval Ordnance Lab., White Oak, Md.
THE ABSORPTION OF LIGHT BY LIGHT AND ITS APPLICATION TO THE CONVERGENCE OF PERTURBATION THEORY, by Howard R. Reiss. 8 Sep 58, 84p. 25 refs. NAVORD rept. 6180; AD-209 365.
Order from LC mi$4.80, ph$13.80 PB 144 987

The mutual absorption of two photon fields is calculated by Dirac electron theory. One photon field is treated accurately in that wave functions are employed which are solutions of the Dirac equation containing the potential of this field in the Hamiltonian. The second photon field is introduced as a perturbation. The results yield the proper small field strength limit and low energy limit. It is proved that perturbation series will converge in this non-second-quantized theory. (Author)

Naval Ordnance Test Station, China Lake, Calif.
USE OF THE IBM ELECTRONIC DATA PROCESSING MACHINE FOR QUANTUM MECHANICAL CALCULATIONS. III. COULOMB, HYBRID AND MONO-NUCLEAR INTEGRALS, by D. S. Villars and Verner Schomaker. 23 Oct 59, 26p. 9 refs. NOTS TP-2349; NAVORD rept. 6608.
Order from LC mi$2.70, ph$4.80 PB 145 353

A program is described for reducing three of the 2-electron quantum mechanical integrals from 6-dimensional integrals to sums of a small number of 2-dimensional integrals. By means of a specially written subroutine which will carry out n multiple quadratures simultaneously, all terms of the sums are computed at the same time. The advantage of numerical quadrature is that it is only necessary to provide the program with the quantum numbers, the internuclear distance and the effective nuclear charges and the machine does all the rest of the bookkeeping. At the present stage the program takes too much machine time but the program will be of value for occasional checks of other methods. Results obtained compare favorably with values from the literature or values computed analytically. (Author)

Plasmadyne Corp., Santa Ana, Calif.
RELAXATION HEATING OF A PLASMA BY SURFACE INTERACTION WITH A MAGNETIC FIELD, by R. P. Treat. Technical note no. 3 on Contract AF 49(638)335. 15 Oct 59, 40p. 7 refs. T-3TN109-335; AFOSR-TN-59-1151.
Order from LC mi$3.00, ph$6.30 PB 144 971

The heating of a fully ionized deuterium plasma by collisional relaxation for temperatures of the order of one kev is explored. The model used for the study consists of a long cylindrical plasma column confined and manipulated by an axial magnetic field that is induced by currents flowing in a one-turn coil surrounding the plasma. Conditions are such that the field is excluded from the interior of the plasma: the interaction between plasma and field is essentially a surface phenomenon.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
THEORY AND APPLICATIONS OF FLOW GRAPHS, by Charles S. Lorens. Doctoral thesis. Rept. on Contract DA 36-039-sc-64637. 15 July 56, 117p. 20 refs. Technical rept. 317; AD-158 736.
Order from LC mi$6.00, ph$18.30 PB 145 437

Our object is threefold: to develop a basic theory of flow graphs; to extend their known application to electrical networks; and to formulate the natural relation between flow graphs and the properties of discrete statistical systems. Part I deals with the first two objectives. Much of the linear theory of flow graphs parallels linear equation theory in such a manner that considerable meaning is given to many classical operations of formulation, inversion, and reduction. Part I covers additive functional systems; inversion; electrical network formulation; mathematical determinants; partitions and expansions of a determinant; rank, positive definite, eigenvalues, and eigenvectors; group multiplication; and transcendental equations. Part II deals with the third objective. The pictorial representation of a discrete statistical system specifies its properties. With flow graphs these properties are conveniently calculated and interpreted directly from the representative graph. The material of Part II covers recurrent events, transient systems, stationary state distributions, sensitivity and variation, generating functions, channel capacity, and information structure. (Author)

Theoretical Chemistry Lab., U. of Wisconsin, Madison.
THE "IMPROVED" FREE VOLUME THEORY OF LIQUIDS, II, by John S. Dahler (Aeronautical Research Lab.) and Joseph O. Hirschfelder. Rept. on Contract AF 33(616)3414. Sep 59, 197p. 24 refs. WADC Technical note 59-234.
Order from OTS $3.00 PB 161 407

The Kirkwood nonlinear integral equation for determining the optimum free-volume of a liquid is integrated by an iterative procedure with the approximation that the cell distribution function is spherically symmetrical. The potential of the system is assumed to be pairwise additive and the interaction between two molecules obeys the Lennard-Jones 12-6 potential. To simplify the computations, the contributions to the cell potential by molecules beyond the first shell of nearest neighbors are calculated as though the molecules were located at their lattice points. The method of Levine, Mayer, and Aroeste was used to optimize the lattice dimensions and take into account the existence of holes. Extensive tables are given for the configurational internal energy, compressibility factor, and configurational entropy. Comparison of the configurational internal energy and compressibility factor with the Monte Carlo calculations indicates that our isotherms correspond to extensions of the crystalling phase into a metastable low density region. Comparison of our configurational entropy with experimental data indicates that we are lacking the entropy of fusion. Our values of the configurational internal energy agree rather well and our values of the compressibility factor agree very poorly with the experimental data. Comparisons are also made with the results of other theoretical treatments. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
A GRAPHICAL SOLUTION OF SHOCK EQUATIONS, by Charles E. Treanor and Marcia J. Williams. Rept. on Contract AF 18(603)141. Nov 59, 46p. 8 refs. Rept. no. AD-1118-A-4; AFOSR-TN-59-1088.
Order from LC mi$3.30, ph$7.80 PB 144 909

A rapid graphical method for calculating the conditions behind a normal shock is described. The method applies to any gas for which the enthalpy is known as a function of pressure and density. The accuracy is limited only by that of the available graph of the gas properties. The necessary working graphs for air, O_2 and N_2 (complete thermodynamic equilibrium) and for NO (without chemical reaction) are included, along with a template for use in attaining the solution. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
THE INFLUENCE OF GAS DISSOCIATION ON HEAT TRANSFER, by William J. Thievon, Gerald A. Sterbutzel, and John L. Beal. Rept. for Feb 57-June 59 on Contract AF 33(616)5143. June 59, 151p. 15 refs. WADC Technical rept. 59-450.
Order from OTS $2.75 PB 161 418

Recovery factor and heat transfer rates for dissociating N_2O_4 gas were determined experimentally under turbulent flow in a tube. Recovery Factor Tests - The range of flow rates for the recovery factor tests was from 208, 580 to 722, 480 lb/hr-ft^2 with a diameter Reynolds number of 89, 420 to 541, 100. The flow velocity ranged from 386 to 845 feet per second. The temperature and dissociation range covered in these tests were 100 to 228°F and .26 to .91 respectively. Heat Transfer Tests - The range of flow rates used for these measurements was from 21, 000 to 90, 000 lb/hr-ft^2 at a length Reynolds number of 65, 000 to 2, 000, 000. The thermal flux at the inside tube wall ranged from 300 to 13, 300 Btu/hr-ft^2. Wall temperatures of the test section were varied from 131 to 370°F with the stream temperature varying from 108 to 222°F. The wall-to-stream temperature differential ranged from 0 to 179°F with a corresponding wall-to-stream enthalpy difference. The range of dissociation at the wall covered from .40 to .998 and the mean stream varied from .31 to .90. Radial velocity and temperature profiles were measured at various stations in the test section. Composition and enthalpy profiles were calculated and local heat

Duke U., Durham, N. C.
AN UNUSUAL STABILITY CRITERION FOR A DIFFERENCE ANALOGUE OF THE HEAT EQUATION, by Jim Douglas, Jr. Rept. on Contract AF 18(600)1341. Aug 58, 6p. 3 refs. AFOSR-TN-58-767; AD-201 922.
Order from LC mi$1.80, ph$1.80 PB 138 176

Frequently in the numerical solution of the heat equation by a difference equation, it is necessary to impose a restriction between the time increment Δt

and the space increment Δx of the form

$$0 < \frac{\Delta t}{(\Delta x)^s} \leq k < \infty.$$

In attempting to obtain a high order correct difference analogue of the heat equation in two space variables, I developed several difference equations for which it is necessary that

$$0 < k \leq \frac{\Delta t}{(\Delta x)^s} < \infty.$$

for stability and convergence. One such analogue is derived in this short note.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
THE EFFECTS OF RESONANT ACOUSTIC VIBRATIONS ON HEAT TRANSFER TO AIR IN HORIZONTAL TUBES, by Jack M. Spurlock, Thomas W. Jackson and others. Rept. on Contract AF 33(616)5742. June 59, 57p. 9 refs. WADC Technical note 59-330.
Order from OTS $1.50 PB 161 361

Results are presented of a series of experiments conducted for the purpose of studying the effects of acoustic vibrations on convection heat transfer in horizontal tubes. The experimental apparatus was calibrated without sound to determine the relationships between local average Nusselt numbers and Graetz numbers in the test section with no sound influences. The results of the calibration tests were reproducible within ±5% and were correlated within a range of Graetz numbers from 60 to 1300 by an analytical equation. Experimental tests were then conducted using sound levels up to 151 decibels in the test section. Experimental evidence is given that a threshold sound pressure level exists below which little or no effect is produced. Above this value, significant increases of up to 75% in the local average Nusselt numbers are produced. This threshold sound pressure level value is approximately 141 decibels. Experimental sound studies were conducted at frequencies of 217 cps, 325 cps, and 500 cps, and at sound pressure levels between 140 db and 151 db for each frequency. The complexity of the phenomena has prevented either a qualitative analysis or an analytical expression for the acoustic effects on heat transfer with the present data. Further studies producing considerably more data are necessary before the analytical phase of this investigation can be accomplished. (Author)

Institute of Engineering Research, U. of Calif., Berkeley.
HEAT TRANSFER, RECOVERY FACTOR AND PRESSURE DISTRIBUTIONS AROUND A CYLINDER NORMAL TO A SUPERSONIC RAREFIED AIR STREAM. PART I. EXPERIMENTAL DATA, by O. K. Tewfik and W. H. Giedt. Rept. on Contract Nonr-222(45). 30 Jan 59, 88p. 16 refs. Technical rept. HE-150-162; Series no. 20, issue no. 124.
Order from LC mi$4.70, ph$13.80 PB 145 090

Local heat transfer, recovery factor, and pressure distributions around a circular cylinder normal to a supersonic rarefied air stream were measured in the Mach number range 1.3 - 5.9, the Reynolds number range 37 - 4100, and at two cylinder wall average temperature levels of 90 K and 210 K, under steady state thermal and flow conditions. The experimental data are presented in tabular and graphical form as Part I of a two-part report. The second part, now in preparation, will present an analysis and comparison of these results with available theories.

National Bureau of Standards, Boulder, Colo.
DESIGN AND CONSTRUCTION OF A LIQUID HYDROGEN TEMPERATURE REFRIGERATION SYSTEM, by D. B. Chelton, J. W. Dean, and B. W. Birmingham. 12 Jan 60, 39p. 11 refs. Technical note no. 38.
Order from OTS $0.75 PB 151 397

Maintaining a liquid hydrogen bubble chamber at 27°K has been achieved with an automatically controlled closed circuit hydrogen refrigeration system of 300 watts capacity. The system is sufficiently flexible to be used on other experimental apparatus requiring refrigeration at liquid hydrogen temperatures. Several control systems are discussed. Experimental evidence is compared to predicted performance for design operating conditions. General design charts are developed that enable heat exchanger lengths and associated operating parameters to be determined for the pertinent heat exchanger configuration when employed in liquid hydrogen refrigerators of other capacities. (Author)

National Bureau of Standards, Boulder, Colo.
HELIUM REFRIGERATION AND LIQUEFACTION USING A LIQUID HYDROGEN REFRIGERATOR FOR PRECOOLING, by D. B. Chelton, J. W. Dean and others. 27 Jan 60, 34p. 7 refs. Technical note no. 39.
Order from OTS $0.50 PB 151 398

Consideration is given to the use of a hydrogen refrigerator to assist in the production of temperatures below those obtained with hydrogen. A hydrogen refrigerator is used to maintain a precooling evaporator at or near 21°K in a helium gas circuit. The helium circuit may be arranged to produce liquid for external use or to produce refrigeration between 21°K and 4.2°K in a closed system. Charts have been developed that show the requirements of the composite helium - hydrogen system and the effect of heat exchanger performance. The relative quantities of refrigeration (hydrogen and helium) at various temperature levels have been determined. (Author)

Research Inst., Temple U., Philadelphia, Pa.
THE FASTEST BURNING FLAME—THE PREMIXED HYDROGEN-FLUORINE FLAME, by A. V. Grosse and A. D. Kirshenbaum. Technical note no. 8 on Study of Ultra High Temperatures, Contract AF 18(600)1475. 2 Feb 59, 77p. 33 refs. AFOSR-TN-59-621.
Order from LC mi$4.50, ph$12.30 PB 144 981

Techniques for premixing pure hydrogen and fluorine gas were developed. Burning velocities, both at 77 and 90°K. of various hydrogen-fluorine mixtures, with and without helium dilution, were determined. The hydrogen-fluorine flame is the fastest flame known and burning velocities up to 2100 cm/sec. at 77°K. were measured. Under the same conditions the hydrogen-oxygen flame has a velocity of approxi-

mately 200 cm/sec. or ten times smaller. The hydrogen-fluorine flame is also characterized by an unusually high flame pressure; a maximum of 60 mm Hg has been determined. (Author)

Research Inst., Temple U., Philadelphia, Pa.
HIGH TEMPERATURE PROJECT, by A. V. Grosse and J. B. Conway. Progress rept. no. 5, 1 July 51-1 Jan 52, on Contract N9onr-87300. 1 Jan 52, 38p. AD-135 204.
Order from LC mi$3.00, ph$6.30 PB 145 093

Experimental work concerned with the combustion of powdered metals: (a) powdered metal feed devices; (b) torch design; (c) operating characteristics; (d) flame temperatures obtained; (e) melting and cutting ability.

Temple U., Philadelphia, Pa.
RESEARCH DIRECTED TOWARD THE ATTAINMENT AND UTILIZATION OF HIGH TEMPERATURE (MULTI-FRAME HIGH SPEED CAMERA, EXPLODING WIRE PHENOMENA AND PLASMA ACCELERATION), by L. Lloyd Bohn, Francis H. Nadig, and Theodore Korneff. Final rept. on Contract AF 19(604)1561. 31 Mar 58, 109p. 14 refs. AFCRC-TR-58-289.
Order from LC mi$5.70, ph$16.80 PB 138 435

The three major topics discussed in this report are: (1) High speed camera, (2) Exploding wire phenomena, (3) Plasma acceleration experiments. A rotating mirror camera was devised for the express purpose of photographing the initial phases in a wire explosion. The camera depends on a unique optical system for forming the images. This makes possible the use of relatively low rotational speeds for frame rates up to 2×10^6 frames per second. The section of the report dealing with exploding wire phenomena has been written with the view of consolidating under one cover as many parameter dependent effects encountered in experiments as present equipment allows. The conclusions are substantiated by current and voltage oscillograms and, wherever possible, by high speed photographic techniques employing image converter and rotating mirror cameras. In the plasma acceleration experiments, the quantitative description is limited to giving orders of magnitude and general effects. The investigations are concerned with the directionality and velocity of the ionized particles. An exploding wire is the source of the plasma. Three methods have been used to study the plasma accelerations: (1) an image converter, (2) rotating mirror camera, and (3) biased gaps. An experimental curve giving average velocity of the plasma as a function of pressure is included.

Wayne State U. Coll. of Engineering, Detroit, Mich.
FREE CONVECTION HEAT TRANSFER, by Joseph Rutkowski. Final summary rept. on Contract DA 20-018-ORD-13356. July 59, 49p. 9 refs.
Order from LC mi$3.00, ph$7.80 PB 145 172

Aspects of research not previously reported are presented in more detail. The large amount of experimental data gathered has made the task of reduction, analysis and discrimination an impossible one at least for the contract period. It is planned in the near future to report the findings of this research as the finalized results are obtained.

Wave Propagation

Centro di Studio Per La Fisica Delle Microonde (Italy).
BABINET'S PRINCIPLES FOR DIFFRACTION AT A PLANE SCREEN WITH DIRECTIONAL CONDUCTIVITY, by G. Toraldo di Francia. Technical note no. 1 on Contract AF 61(052)67. 30 Apr 58, 9p. 8 refs. AFCRC-TN-58-198; AD-133 744.
Order from LC mi$1.80, ph$1.80 PB 137 911

A plane and infinitely thin screen Σ_1 of any type of connection is a part of a plane $\Sigma_1 + \Sigma_2$. A system of regular lines (lines of conductivity) is defined over Σ_1, such that through each point of Σ_1 there passes one line of the system, and only one. Conductivity is assumed to be infinite along the lines of conductivity, and to vanish along their normals. A general electromagnetic wave is incident upon Σ_1. A complementary case, in the sense of Babinet's principle, is obtained when Σ_1 has still the same properties, while Σ_2 becomes a screen of infinite and omnidirectional conductivity. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
DIFFRACTION OF SCALAR WAVES BY A CIRCULAR APERTURE, by J. Bazer and A. Brown. Rept. on Contract AF 19(604)5238. Aug 59, 42p. 12 refs. Research rept. no. EM-144; AFCRC-TN-59-594; AD-227 948.
Order from LC mi$3.30, ph$7.80 PB 145 071

The problems of the diffraction of scalar waves by a circular aperture in a perfectly soft and in a perfectly rigid infinite planar screen are treated, assuming axially-symmetric excitation. New integral representations of the solutions are presented. The unknown functions $f_1(t)$ and $f_2(t)$ are required to be odd and even analytic functions of t, respectively, regular in a neighborhood of the unit disc. The integrals satisfy the time-reduced wave equation, the radiation condition, and the boundary conditions; and have the appropriate edge behavior. A brief and elementary calculation reveals the f's to be solutions of Fredholm-type integral equations of the second kind whose kernels are small when ka (the wave number x the radius of the aperture) is small. The integral equations guarantee the existence of the desired types of f's whenever the exciting fields are suitably regular functions of the axis of symmetry in a neighborhood of the aperture, and, lead to approximate expressions for the f's when ka is small. These approximates are used to calculate the aperture fields, the far fields, the transmission coefficients, and the edge behaviors. The results obtained are in agreement with known results and, for some of these quantities, are more accurate, in that higher powers

of ka are included. In the rigid-screen problem, for all positive values of ka, the form of the edge behavior is determined and a simple proof is given of the unique existence of the solution. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
ABSORPTION COEFFICIENTS OF AIR FROM 22,000° TO 220,000°, by Baxter H. Armstrong, Dan H. Holland, and Roland E. Meyerott. Final rept. on Contract AF 29(601)524. 15 Aug 58, 166p. 23 refs. AFSWC-TR-58-36; LMSD-5135; AD-218 905.
Order from LC mi$7.80, ph$25.00 PB 144 904

The photoelectric and free-free absorption coefficients of air have been computed over the temperature range 2 to 20 ev, density range $\sim 10^{-5}$ normal to normal, and energy range 1 ev to 1 kev. The occupations of ionic states were computed with the grand-canonical ensemble statistical method described by Brachman and Meyerott (ANL-4986 unpublished). For terms of principal quantum numbers 2 and 3, empirical energy values were used where known, and estimated by isoelectronic interpolation, or the Bacher-Goudsmit method (Phys. Rev. 46:1934), were made where empirical values are lacking. For $n \geq 4$, the Bohr formula with quantum defects was used, and separate angular momentum levels were included to $n = 9$. Multiple excitations were partially included by using one-electron levels of ionic cores for all core possibilities of the $n = 2$ shell. Screened coulomb gaunt factors were used, and fractional parentage coefficinets were employed in order to account for transitions from equivalent electron states. (Author)

Puerto Rico U., Mayaguez.
PECULIARITIES AND SEASONAL VARIATIONS OF T. E. BACKSCATTER ECHOES OBSERVED AT MAYAGUEZ, PUERTO RICO, by B. Dueño. Research rept. 2 on Contract AF 49(638)172. [1959] 16p. 3 refs. AFOSR-TN-59-889; AD-225 968.
Order from LC mi$2.40, ph$3.30 PB 144 658

As a result of a backscatter experiment on 21.6 mcs. and 40.68 mcs. it has been observed that long range transequatorial echoes, which are most prevalent during the equinoxial periods, also exhibit a minimum of T. E. activity during the solstitial periods June, July and December and January. The mechanism for the production of long range transequatorial echoes (L. R. T. E.) is not well understood. Comparison of our data with N. B. S. propagation predictions from the combined action of the evening equatorial bulge and sizable horizontal gradients of ionization in the neighborhood of the geomagnetic equator. The minimum during December and January can be ascribed to the small horizontal gradient prevailing at the time. During June, July the horizontal gradient is not as small as in December, January. This fits with the observation that T. E. activity is not as low on June, July as it is on December and January. Due to the combined action of the equatorial bulge and the sizable horizontal gradients in the neighborhood of the g. m. equator radio waves of sufficiently high frequencies will be launched into the ionosphere in directions along the maximum of electron density of the elevated layer. To produce focussing by a bundle of rays a shallow distribution of electron density in the layer is necessary. This is in agreement with the postulated decrease in electron density as the geomagnetic equator is approached. (Author)

Schwinger, Julian, Cambridge, Mass.
INVESTIGATION OF HIGH FREQUENCY LIMITATIONS IN MILLIMETER WAVE GENERATORS, by Julian Schwinger. Semiannual rept. no. 3, Jan-July 58, on Contract DA 36-039-sc-73136. [1958] 25p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 145 231

The interaction between the electromagnetic field and a number of identical atomic systems, individually characterized by an electric dipole moment and two energy levels, is analyzed for the case where the atomic systems are inside a lossy cavity and exposed to a coherent driving field, resonance being assumed between atomic system, cavity, and driving field. The problem of introducing loss into a quantum-mechanical formalism is treated. Formal operator expressions are obtained for the field variables which include the absorption and the fluctuation (both thermal and quantum-mechanical) effects of the loss mechanism. (Author) (See also PB 142 633)

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Air Force Cambridge Research Center, Bedford, Mass.
A CONCISE BIBLIOGRAPHY OF THE LITERATURE ON ARTIFICIAL INTELLIGENCE, by Alice M. Pierce. Sep 59, 22p. 243 refs. AFCRC-TN-59-773.
Order from LC mi$2.70, ph$4.80 PB 145 105

This bibliography is a bare listing of the literature on "artificial intelligence" as the term applies to systems whose operating behavior would be called "intelligence" if exhibited by man. Unindexed, it has a minimum of cross references to related subjects, most references to physiology, psychology, logic, automata theory, decision theory, theory of games, and even neural net theory, having been omitted. (Author)

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
PROCEEDINGS OF SHOCK TUBE SYMPOSIUM [NO. 1] 26-27 FEBRUARY 1957. 205p. 63 refs. SWR-TM-57-2.
Order from LC mi$9.30, ph$31.80 PB 145 141

Contents:
Air Force Special Weapons Project's interest in shock tube research;
The Air Force shock tube as a research tool;
Design and performance of the General Electric six-inch shock tunnel facility;
The development of a shock tube to generate variable stepped shock fronts;
Studies of transient air forces on two-dimensional airfoils;

Study of grids in shock tubes;
The development of the shock tube facility for airfoils studies;
The surface film thermometer: a versatile shock tube technique;
Some observations of bifurcated reflected shock waves;
Numerical solution for the reflection of a compression wave from a rigid wall;
The use of the shock tube in hypersonic research;
Study of re-entrant corners

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
PROCEEDINGS OF SHOCK TUBE SYMPOSIUM [NO. 2] 5-6 MARCH 1958. 308p. 133 refs. SWR-TM-58-3.
Order from LC mi$11.10, ph$47.10 PB 145 142

Contents:
AFSWP interest in shock tube research
Shock tube wind tunnel research at the Naval Ordnance Laboratory
Shock tube studies of blast pressures behind frangible wall panels
Comparison of shock tube and field test data on the pressure build-up behind frangible walls
Some results from use of a shock tube for biomedical investigation
Experimentation with General Electric six-inch shock tunnel
Pressure-time history in a chamber subjected to shock wave filling through an orifice
Determination of the time history of the flow field about a blunt body in a shock tube
Some experiments with periodic shocks
On the effect of attenuation on gas dynamic measurements made in shock tubes
A method of generating various desired pressure pulses in a shock tube
Problems in the use of piezogauges for shock tube instrumentation
Determination of the dynamic response characteristics of pressure measuring systems utilizing shock tube testing techniques
High temperature effects in shock structure
Shock wave calculations for high temperature gases
Laminar and turbulent heat transfer measurements on a hemispherical cylinder in the Lockheed 3-inch shock tube
A particular application of the conventional shock tube for the study of ignition and combustion in subsonic flow
One dimensional blast waves from an axially symmetric electrical discharge (See also PB 145 141)

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
PROCEEDINGS OF SHOCK TUBE SYMPOSIUM [NO. 3] 10-12 MARCH 1959. [1959] 270p. 90 refs. SWR-TM-59-2.
Order from LC mi$11.10, ph$41.10 PB 145 143

Contents:
Resume of experiments conducted in the high pressure shock tube of Gas Dynamics Laboratory at NASA
A probe for determining flow conditions in a short duration hypersonic stream
Calculation of the flow phenomena in the CONVAIR free jet shock tunnel facility
An explosive driven conical shock tube for the study of spherical shock waves
Shock tube investigation of hydrogen dissociation
Observations of ultra-violet absorption behind strong shock waves in oxygen
Diffusion effects on shock structure in a plasma
Technique of pressure measurement on an airfoil in a shock tube
Application of pressure and force transducers in hypersonic shock tunnel aerodynamic experimentation
Biological experiments utilizing a closed-end shock tube
Program for the NCEL blast simulator
Structural integrity of spread foundations subjected to extreme horizontal impulses
The shock chamber: A device for producing high strength spherically expanding shock waves
A one-inch force gage for drag measurements in the shock tube
Changes in pressure drag caused by shielding
Correlation between shock tube and wind tunnel drag coefficients
Interaction of blast waves with wings
Experiments and theory on explosive decompression in the six-foot shock chamber
Theory on filling process in chamber, shock tube, and field tests
Diaphragm calibration techniques in a 2.00-inch diameter shock tube
(See also PB 145 142)

Army Research Office, Washington, D. C.
ARMY RESEARCH TASK SUMMARY, 1960. VOLUME 6. MATERIALS TECHNOLOGIES, MATHEMATICS, AND OPERATIONS RESEARCH. 451p.
Order from OTS $4.50 PB 161 138

Contents:
Materials Technologies:
Ceramic technology
Chemical technology
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Metallurgical technology
Non-metallic materials technology
Photographic technology
Mathematics:
Multiple
Algebra and number theory
Analysis
Computation methods and techniques
Geometry and topology
Mechanics
Numerical and graphical methods
Operations analysis
Probability and statistics
Operations Research
(See also PB 151 499)

Dynamic Analysis and Control Lab., Mass. Inst. of Tech., Cambridge.
NONLINEAR CONTROL SYSTEMS WITH STATISTICAL INPUTS, by Richard C. Booton, Jr.,

1 Mar 52, 36p. 6 refs. Rept. no. 61. ATI-150 275.
Order from LC mi$3.00, ph$6.35 PB 145 169

An approximation method is developed for the analysis of nonlinear systems that are composed of linear devices, feedback circuits, and purely amplitude-sensitive elements. The input functions are assumed to be defined only statistically, and consideration is given to nonstationary inputs. Initial consideration is given to the specific case of a simple-lag system in which the nonlinearity occurs as a rate limiting. The input is assumed to be a stationary Gaussian signal, and calculations are made of the rms error of the system. The actual system is simulated on an analogue computer, and the results are shown to agree with the predicted theoretical results within the accuracy of the computer. Following this particular case the results are extended to apply to more general situations.

Signal Corps Publications Agency, Fort Monmouth, N. J.
PREPARATION OF MANUSCRIPTS. PART ONE, TEXT. 15 Mar 57, 54p. SIG 730-1, supersedes SIG 730-1, Part One, 5 Mar 56.
Order from LC mi$3.60, ph$9.30 PB 144 998

This writing guide is part of Military Specification MIL-M-10953A (SigC). It specifies standards of style, presentation, and format for publications prepared for or by The Signal Corps Publications Agency.

Signal Corps Publications Agency, Fort Monmouth, N. J.
PREPARATION OF MANUSCRIPTS. PART TWO, ILLUSTRATIONS. 16 Oct 56, 81p. SIG 730-1.
Order from LC mi$4.80, ph$13.80 PB 144 999

This manual covers the requirements for reproducible illustrations that are: (1) Procured under the requirements of Military Specification MIL-M-10953 (SigC). (2) Prepared or submitted to The Signal Corps Publications Agency for use in technical manuals, field manuals, technical bulletins, changes, SIG manuals, school texts, training texts, and other publications.

Communication Theory

Ohio State U. Research Foundation, Columbus.
TESTS OF THE AURAL COMPREHENSION OF ENGLISH BY FOREIGN STUDENTS, by Henry M. Moser, John J. O'Neill, and Susan M. Wolfe. Technical rept. no. 50 on Contract AF 19(604)1577. Aug 58, 13p. 7 refs. AFCRC-TR-58-57; AD-152 649.
Order from LC mi$2.40, ph$3.30 PB 137 787

Parts of two tests of aural comprehension of English for foreign students were administered to forty-four foreign students representing 25 nationalities and varying backgrounds in English. All of the students were post graduates. The tests used were The Lado Test of Aural Comprehension, Form C and The MDAP English Proficiency Examination, Form B. Thirty orally-presented items were given from the MDAP test and 60 from the Lado Test. The data were analyzed in terms of the differences between mean scores (t test) and a product moment correlation (r). The results of the t test indicated significant differences between the two tests. This might be accounted for by the differences in numbers of items presented on each test as well as the difference in performance levels for each test as established by native speakers of English. The statistical evaluation of r indicated that there was a significant relationship between scores obtained on the two tests. The MDAP test deals more extensively with military vocabulary than does the Lado but they are both capable of evaluating the aural comprehension of foreign nationals. The Lado test is less time-consuming and would probably be preferred when technical language evaluation is not important. (Author)

Information Theory

Stanford U., Calif.
DETERMINING BOUNDS ON INTEGRALS WITH APPLICATIONS TO CATALOGING PROBLEMS, by Bernard Harris. Technical rept. no. 18 on Contract Nonr-225(21). 21 Apr 58, 58p. 8 refs; AD-158 558.
Order from LC mi$3.60, ph$9.30 PB 138 580

Photographic Equipment

Naval Ordnance Test Station, China Lake, Calif.
DEVELOPMENT OF AN UNDERWATER HOUSING FOR 35MM MITCHELL CAMERAS, by R. O. White. 28 Sep 59, 21p. NOTS TP-2323; NAVORD rept. 6591.
Order from LC mi$2.70, ph$4.80 PB 144 949

This report describes the development and design features of a camera housing and orienting mount for a 35mm Mitchell motion picture camera used in underwater metric photography. The housing is designed for operating depths ranging to 200 feet, and features a corrector lens which compensates for the increased refractive index of sea water. (Author)

SOCIAL SCIENCES

National Bureau of Standards, Washington, D. C.
DISTRIBUTION OF INCOMING LETTERMAIL AT

THE BALTIMORE, MARYLAND CITY POST OFFICE, by Bernard M. Levin and Arthur E. Newman. Oct 59, 121p. 4 refs. Technical note 33.
Order from OTS $2.50 PB 151 392

Lettermail at the Baltimore, Md. post office was sampled and studied for the purpose of estimating the distribution characteristics of letters for local delivery. Separate studies were conducted for first- and third-class mail and the results are reported both separately and combined. The study demonstrated an effective method of sampling incoming lettermail. It also yielded data needed for the design of efficient procedures for sorting mail using machinery now being developed. (Author)

Documentation

Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio.
STUDY OF INDEXING AND MACHINE SEARCHING, by T. H. Rees, Jr., Allen Kent, and J. W. Perry. Rept. on Contract AF 30(602)1498. 1 Apr 59, 123p. 32 refs. RADC-TR-59-56; AD-213 786.
Order from LC mi$6.30, ph$19.80 PB 144 655

A number of machines and systems have been developed or adapted to cope with the documentation problem. A particularly difficult area of application of these machines and systems is for the searching and correlating of fragmentary information that is scattered through large files. A set of principles for coping with this area of application has been developed at the Center for Documentation and Communication Research for the American Society for Metals, embodying a balanced approach to: (1) detailed analysis of documents, (2) use of a semantic (thesaurus-like) dictionary, (3) a system of standardized simplified syntax, (4) a new set of machine functions as embodied in the WRU Searching Selector, and (5) a strategy for exploiting these capabilities. These methods have been applied to a file of articles from the New York Times. Also a modification of this approach has been applied to a previously generated subject index and a previously classified set of documents. The New York Times file has been searched in a simulated commercial intelligence situation and the results have been analyzed and evaluated. The files generated have also been studied from the point of view of applying these methods to equipment such as the Eastman Kodak Minicard and the IBM 650. Also covered during this program have been the development of methods for the automatic encoding of information files applying methods analogous to machine translation routines.

Documentation, Inc., Washington, D. C.
MEANING, LINGUISTIC STRUCTURES AND STORAGE AND RETRIEVAL SYSTEMS, by Mortimer Taube. Rept. on Contract AF 49(638)91. Feb 57, 15p. 9 refs. AFOSR-TN-57-125; AD-120 482.
Order from LC mi$2.40, ph$3.30 PB 137 728

This paper attempts to establish the positive thesis that storage and retrieval theory and the design of storage and retrieval systems need not concern itself with "the relationship between concepts and the words and symbols in which they are expressed", nor with the attempts to base such relationships on the distinction between nominal classes and "real" classes.

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, Mar 60.
Order from OTS $1.25, $10.00/year PB 161 279

Contents:
Articles:
Protection of columbium for high-temperature service, by B. F. Brown
Low-temperature R-F probe for nuclear magnetic resonance, by F. E. Geiger, Jr.
Frequency stabilization of point-to-point ISB circuits, by C. L. Spencer
Scientific program:
Astronomy and Astrophysics: Linear readout from resistance thermometers
Chemistry: Factors influencing the corrosivity of diester-base oils for lubricating aircraft engines. Reduction of the hydrogen overvoltage in nickel electrodes with palladium
Mathematics: NAREC computer program for zero-lift, multistage, launching vehicle trajectories
Mechanics: Mechanical properties of elastically shocked low-carbon steel specimens at temperatures between -300°F and +70°F. Effect of radiation upon ceramic-bonded strain gages. Data processing to obtain shock spectra
Metallurgy and Ceramics: Crack propagation tests of high-strength sheet materials--part iv--effect of warm pre-straining. Effect of environment on the creep-rupture properties of nickel. Specialized equipment for disassembly of highly radioactive reactor experiments
Nuclear and Atomic Physics: A standard source of radiation for radiac detectors
Optics: An f/3.3 medium-dispersion grating spectrograph. Influence of atmosphere on optical resolution in a typical Nevada tunnel
Radio: Broadband impedance transformers. Comparison of microwave and Langmuir probe techniques for the investigation of electrical discharges
Solid State Physics: Optical measurements of carefully prepared single crystals of KCl with wide range of Tl concentrations. X-ray analysis of diffusion of Nb with Cr, Fe, Ni, Mo, and stainless steel
Supporting techniques:
Aluminosilicate glass

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General

Air fluorescence in the upper atmosphere and its relation to the detection of nuclear explosions in space, by D. R. Westervelt. Los Alamos Scientific Lab., N. Mex. June 59. Contract W-7405-eng-36. 25 p. Order from LC. Mi $2.70, ph $4.80.

AECU-4499

Graphite-to-metal seal screening tests, September 1958, by J. S. Gilhart. Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va. Changed from OFFICIAL USE ONLY July 10, 59. Contract AT(30-1)-1940. 21p. Order from LC. Mi $2.40, ph $3.30.

BAW-1053

Operating manual for 105-C metal examination facility, by J. M. Fouts. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Oct., 58. 72p. Order from LC. Mi $4.50. ph $12.30.

HW-58220

Report on hapo unitized microfilm drawing system, by J. Durbin. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Oct. 59. 34p. Order from LC. Mi $3.00, ph $6.30.

HW-62099

Natural frequencies of structure 3.1.1, by Lydik S. Jacobsen and William M. Wells. Sandia Corp., Albuquerque, N. Mex. Nov 51. Changed from OFFICIAL USE ONLY Nov 59. 59p. Order from LC. Mi $3.60, ph $9.30.

SC-2090 (Tr)

Subject headings used by the USAEC Technical Information Service, by C. W. Hargrave. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Jan. 60. 476p. Order from OTS. $6.00.

TID-5001

Summary report of reactor hazards associated with the high temperature test facility, by W. A. Vogele and others. Atomic Energy Commission by Bettis Atomic Power Laboratory, Westinghouse Electric Corporation, Pittsburgh, Pa. Aug 59. Contract AT-11-1-Gen-14. 53p. Order from OTS. $1.50.

WAPD-SC-630

Biology and Medicine

Radiosensitivity of the Lymphocyte, Chicago, Univ. (1958?) Contract AT(11-1)-144. 7p. Order from LC. Mi $1.80, ph $1.80.

AECU-4334

Poliar absorption of mineral nutrients with special reference to the use of radioisotopes and the "leaf washing technique" (thesis), by W. H. Jyung. Michigan State Univ., East Lansing. 1959. 54p. Order from LC. Mi $3.60, ph $9.30.

AECU-4433

The effects of radioactive substances on plant pathogens and other microorganisms, Annual Report for Year, October 1, 1958 to September 30, 1959. University of Minnesota, Minneapolis, Minn. Sep 59. Contract AT(11-1)-42. 25p. Order from LC. Mi $2.70, ph $4.80.

AECU-4476

Biological and Medical Research Division semiannual report. July through December, 1958, Argonne National Laboratory, Lemont, Ill. Dec 59. Contract W-31-109-eng-38. 109p. Order from OTS. $2.50.

ANL-6093

A study of techniques and the development of equipment for decanning EBR-II fuel elements, by J. P. Simon. Argonne National Laboratory, Lemont, Ill. Jan 60. Contract W-31-109-eng-38. 21p. Order from OTS. 75 cents.

ANL-6106

Radiation-induced somatic mutations in plants, by A. H. Sparrow and R. L. Cuany. Brookhaven National Lab., Upton, N. Y. (1959?) 10p. Order from LC. Mi $1.80, ph $1.80.

BNL-4296

Long-term ecological study of the Oak Ridge area: II. Observations on the mammals with special reference to Melton Valley, by. J. C. Howell and P. B. Dunaway. Oak Ridge National Lab., Tenn. Oct 59. 24p. Order from LC. Mi $2.70, ph $4.80.

CF-59-10-126

A device for the collection of fecal specimens, by G. F. Stone. Oak Ridge National Lab., Tenn. Nov 59. 7p. Order from LC. Mi 1.80, ph $1.80.

CF-59-11-8

Portable radiation instrumentation standarization, by W. G. Spear. Hanford Atomic Products Operation, Richland, Wash. Sep 59. Contract AT(45-1)-1350. 39p. Order from OTS. $1.00.

HW-60404

Semi-Annual Report For Period Ending June 30, 1959. by Hymer L. Friedell. Western Reserve Univ., Atomic Energy Medical Research Project, Cleveland, Ohio. June 59. Contract W-31-109-eng-78. 114p. Order from LC. Mi $6.00, Ph $18.30.

NYO-2063

Effect of segmental gut shielding on mortality from intestinal radiation, by J. C. Smith. Western Reserve University. Atomic Energy Medical Research Project, Cleveland, Ohio. Oct 59. 20p. Order from OTS. 50 cents.

NYO-2064

Effect of irradiation on cell division and nucleic acid synthesis in strain U-12 fibroblasts, by H. Harrington. Western Reserve University. Atomic Energy Medical Research Project, Cleveland, Ohio. Dec 59. Contract W31-109-eng-78. 21p. Order from OTS. 50 cents.

NYO-2907

An analogue computor for the generalized three-compartment model of transport in biological systems, by E. C. Gregg. Western Reserve University. Atomic Energy Medical Research Project, Cleveland, Ohio. Dec 59. Contract W31-109-eng-78. 24p. Order from OTS. 50 cents.

NYO-2906

Neutron flux and tissue dose studies with fission threshold detectors. Part I. Experimental measurements, by G. S. Hurst and others. Oak Ridge National Lab., Tenn. Mar 54. Contract W-7405-eng-26. 13p. Order from LC. Mi $2.40, ph $3.30.

ORNL-1671 (Del)

Determination and evaluation of the radiation field above White Oak Lake bed (thesis), by P. K. Lee and S. I. Auerbach. Oak Ridge National Lab., Tenn. Sep 59. Contract W-7405-eng-26. 72p. Order from LC. Mi $3.90, ph $10.80.

ORNL-2755

To investigate, develop, and evaluate radioisotopes for teletherapy. Final report. Arkansas University School of Medicine, Little Rock Ark. Sep 59. Contract AT-(40-1)-1771. 19 p. Order from LC. Mi $2.40, ph $3.30.

ORO-208

Whole body counters, by H. E. Voress. Atomic Technical Information Service Extension, Oak Ridge, Tenn. Jan 60. 8p. Order from OTS. 50 cents.

TID-3543

Relationships between the geologic environment and mortality from congenital malformation, by J. Kratchman and D. Grahn. Atomic Energy Commission Technical Information Service Extension, Oak Ridge, Tenn. Aug 59. 20 p. Order from OTS. $2.00.

TID-8204

Reprocessing of irradiated fisiion reactor fuel and breeding material, by J. M. Jacobs. Atomic Energy Commission Technical Information Service Extension, Oak Ridge, Tenn. Jan 60. 39p. Order from OTS. $1.25.

TID-3529(1st rev.)

Morphology and functional relations of sex chromatin in cultured amnion cells, by C. P. Miles. University of California, School of Medicine, Los Angeles. July 59. Contract AT-04-1-Gen-12. 28p. Order from LC. Mi $2.70, ph $4.80.

UCLA-443

A bibliography of biological applications of autoradiography, 1958 through 1959, by M. E. Johnston. University of California. Lawrence Radiation Lab., Berkeley, Calif. Aug 59. Contract W-7405-eng-48. 23p. Order from LC. Mi $2.70, ph $4.80.

UCRL-8901

Current-switching circuitry, by J. G. Salvador. University of Califronia. Lawrence Radiation Laboratory, Berkeley, Calif. Jan 60. Contract W-7405-eng-48. 33p. Order from OTS. $1.00.

UCRL-9035

Distribution and excretion of indium-114m after multiple intramuscular injection to the rat, by G. A. Smith and others. University of Rochester, Atomic Energy Project, Rochester, N. Y. June 59. Contract W-7401-eng-49. 65p. Order from LC. Mi $3.90, ph $10.80.

UR-554

The chemical toxicity of thorium dioxide following inhalation by laboratory animals, by H. C. Hodge and others. The University of Rochester Atomic Energy Project, Rochester, N. Y. Jan 60. Contract W-7401-eng-49. 33p. Order from OTS. $1.00

UR-562

Bibliography on the biological effects of thorium, by E. Hutchinson. The University of Rochester, Atomic Energy Project, Rochester, N. Y. Jan. 60. Contract W-7401-eng-49. 47p. Order from OTS. $1.50.

UR-563

Chemistry—General

Changes in extractors to prevent emulsions, by H. V. Farr and others. Mallinckrodt Chemical Works, St. Louis, Mo. Sep 59. 34p. Order from LC. Mi $3.00, ph $6.30.

A-1084

Analysis of yttrium oxide exchange samples, by C. J. Rodden. New Brunswick Lab., Atomic Energy Commission, N. J. July 59. 52p. Order from LC. Mi $3.60, ph $9.30.

AECD-4288

Progress report no. XXV, Massachusetts Inst. of Tech., Cambridge Lab. for Insulation Research, Cambridge, Mass. July 59. Contracts Nonr-1841(10); Nonr-1841(50); AT(30-1)-1937; AF19(604)-5482; and AF33(616)-5920. 88p. Order from LC. Mi $4.80, ph $13.80.

AECU-4306

An orifice plate pulse column for liquid-liquid extraction (thesis), by D. C. O'Brien. Massachusetts Institute of Tech., Oak Ridge, Mass. Aug 54. Contract W-7405-eng-26. 70p. Order from LC. Mi $3.90, ph $10.80.

AECU-4329

Catalytic combination of hydrogen and oxygen in thoria slurries. Part I. Technical report no. IV, by C. H. Pitts and others. University of Utah, Salt Lake City, Utah. May 59. Contract W-7405-eng-26, Subcontract 1075. 25p. Order from LC. Mi $2.70, ph $4.80.

AECU-4345

Equilibrium extraction characteristics of alkyl amines and nuclear fuels metals in nitrate systems. Quarterly Progress Report IV for the period April 1-June 30, 1959, by E. A. Mason and V. C. Vaughen. Massachusetts Institute of Tech., Cambridge Mass. June 59. Contract W-7405-eng-26, Subcontract 1327. 42p. Order from LC. Mi $3.30, ph $7.80.

AECU-4351

Progress report for July 1959. Technical report no. 8. Anderson Physical Lab., Champaign, Ill. 1959. Contract AT(11-1)-544. 7p. Order from LC. Mi $1.80, ph $1.80.

AECU-4359

Progress report for the month July 1959, by L. Hendricks. Anderson Physical Lab., Champaign, Ill. Aug 59. Contract AT(11-1)-544. 7p. Order from LC. Mi $1.80, ph $1.80.

AECU-4360

Exploration of radiometric methods. Report no. 2, by W. J. Driscoll and E. A. Huff. Nuclear-Chicago Corp., Chicago, Ill. Sep 59. Contract AT(11-1)-695. 24p. Order from LC. Mi $2.70, ph $4.80.

AECU-4417

Applications of rare earths to ferrous and non-ferrous alloys, by J. F. Collins and others. Gereral Electric Co. Aircraft Nuclear Pro-Pulsion Dept., Cincinnati, Ohio. Nov. 59. 26p. Order from LC. Mi $2.70, ph $4.80.

AECU-4424

Isotopic method for age determination of industrial products. Quarterly progress report, July-September 1959, by T. C. Gregson and S. W. Waisbrot. Goodyear Tire and Rubber Co., Akron, Ohio. 1959. Contract AT(11-1)-719. 30p. Order from LC. Mi $3.00, ph $6.30.

AECU-4441

Organic coolant reclamation. Quarterly progress report no. 3 for June 15, 1959-September 15, 1959, by R. J. Wineman and others. Monsanto Chemical Co., Everett, Mass. Oct 59. Contract AT(11-1)-705. 22p. Order from LC. Mi $2.70, ph $4.80.

AECU-4447

Exploration of radiometric methods. Report no. 3, by W. J. Driscoll. Nuclear-Chicago Corp., Chicago, Ill. Nov 59. Contract AT(11-1)-695. 8p. Order from LC. Mi $1.80, ph $1.80.

AECU-4471

Plate height in gas chromatography, by J. C. Giddings and others. University of Utah, Salt Lake City, Utah. 1959. 18p. Order from LC. Mi $2.40, ph $3.30.

AECU-4474

Final report on electron spin resonance spectra of radicals. Washington University, St. Louis, Mo. 1959. Contract AT(11-1)-85. 6p. Order from LC. Mi $1.80, ph $1.80.

AECU-4477

Chemical engineering division summary report for July, August and September 1957. Argonne National Lab., Lemont, Ill. Dec 57 Contract W-31-109-eng-38. 135p. Order from LC. Mi $6.90, ph $21.30.

ANL-5789-(Del)

Literature survey of the properties of fission product oxides, fluorides, and oxyfluorides, by G. Tennenhouse and M. J. Steindler.

Argonne National Lab., Lemont, Ill. July 59. 75p. Order from LC. Mi $4.50, ph $12.30.
ANL-RCV-SL-1545

U_3O_8 single crystals, by W. B. Wilson. General Electric Atomic Products Division Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Jan. 55. Contracts AF33(600)-38062 and AT(11-1)-171. 9p. Order from OTS. 50 cents.
APEX-187

New concepts for control and use of nuclear explosions, by F. B. Porzel. Illinois Institute of Tech., Armour Research Foundation, Chicago, Ill. Apr 59. 33p. Order from LC. Mi $3.00, ph $6.30.
ARF-TM-421

Distribution of radioelements in a qualitative analysis scheme, by M. M. Vick and S. A. Reynolds. Oak Ridge National Lab., Tenn. Dec 53. Contract W-7405-eng-26. 5p. Order from LC. Mi $1.80, ph $1.80.
CF-53-12-110

Measurement of the viscosity of composition 31, by S. I. Cohen and T. N. Jones. Oak Ridge National Lab., Tenn. Dec 55. 3p. Order from LC. Mi $1.80, ph $1.80.
CF-55-12-128 (Del)

Compendium of experimental results of the circulation of aqueous thorium oxide slurries in toroids, by G. E. Moore and others. Oak Ridge National Lab., Tenn. Apr 57. 68p. Order from LC. Mi $3.90, $10.80.
CF-57-4-85

On the chemistry of thermonuclear reactor breeder blankets, by M. T. Robinson. Oak Ridge National Lab., Tenn. Feb 58. Contract W-7405-eng-26. 9p. Order from LC. Mi $1.80, ph $1.80.
CF-57-12-39 (Rev)

Evaluation of liner material and product consolidation in the druhm process, by D. R. Edwards. Oak Ridge National Lab., Tenn. Sep 59. 10p. Order from LC. Mi $1.80, ph $1.80.
CF-59-8-118

Results of examinations of fused salt mixtures by optical and x-ray diffraction methods, by R. E. Thoma. Oak Ridge National Lab., Tenn. Oct 59. 72p. Order from LC. Mi $4.50, ph $12.30.
CF-59-10-18

Effect of excess acid on two-liquid-phase temperature limits for the homogenous reactor fuel solution and its concentrates, by R. E. Moore and W. L. Marshall. Oak Ridge National Lab., Tenn. Nov 59. Contract W-7405-eng-26. 12p. Order from LC. Mi $2.40, ph $3.30.
CF-59-11-27

Liquid-liquid immiscibility above 300°C in the system UO_3-SO_3-N_2O_5-H_2O, by C. J. Barton and others. Oak Ridge National Lab., Tenn. Nov. 59. 23p. Order from LC. Mi $2.70, ph $4.80.
CF-59-11-64

Turbidimetric microdetermination of sulfate in plutonium solutions, by H. D. Warren and A. Brunstad. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Mar 58. Contract W-31-1091eng-52. 6p. Order from LC. Mi $1.80, ph $1.80.
HW-55349

A review of uranium oxidation, by A. J. Scott. Hanford Atomic Products Operation Richland Wash. July 59. Contract AT(45-1)-1350. 16p. Order from OTS. 50 cents.
HW-61851

Zirconium fluoride phase studies. II. Sodium fluozirconate phase relationships, by A. J. Moffat. Phillips Petroleum Co., Atomic Energy Division, Idaho Operations Office, Idaho Falls, Idaho. Dec 59. Contract AT(10-1-)-205. 20p. Order from OTS. 50 cents.
IDO-14499

Isotopic analysis of boron as trimethyl borate, by R. M. Abernathey. Phillips Petroleum Co., Atomic Energy Division, Idaho Operations Office, Idaho Falls, Idaho. Jan 60. Contract AT(10-1)-205. 8p. Order from OTS. 50 cents.
IDO-14503

Preparation of yttrium fluoride using fluorine, by R. L. Tischer and G. Burnet. Ames Laboratory, Iowa State College, Ames, Iowa. June 59. Contract W-7405-eng-82. 41p. Order from OTS. $1.25.
IS-8

The determination of the melting point, the vapor pressure, and the decomposition temperature of yttrium tri-iodide, by D. H. Dennison and others. Ames Laboratory at Iowa State University of Science & Technology Iowa. Nov 59. Contract W-7405-eng-82. 16p. Order from OTS. 50 cents.
IS-57

TCI--An auxiliary one dimensional transient conduction code for use with the art, spy and ter reactor design codes, by J. W. Millard. Knolls Atomic Power Lab., Schenectady, N. Y. Sep 59. Contract W-31-109-eng-52. 59p. Order from LC. Mi $2.70, ph $4.80.
KAPL M-DGM-3

The determination of aluminum, iron, and silicon in silver-cadmium-indium alloys, by J. R. Ciaranello. Knolls Atomic Power Lab., Schenectady, N. Y. Aug 59. Contract

W-31-109-eng-52. 10p. Order from LC. Mi $1.80, ph $1.80.

KAPL-M-JRC-1

A collection of mass spectrometric data of substituted borazoles and their benzene analogs, by E. D. Loughran and C. L. Mader. Los Alamos Scientific Laboratory of the University of California, Los Alamos, N. Mexico. Jan 60. Contract W-7405-eng-36. 37p. Order from OTS. $1.25.

LA-2368

Latent heat of vaporization and vapor pressure data for organic coolants, by R. W. Burkhardt. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Apr 58. 14p. Order from LC. Mi $2.40, ph $3.30.

NAA-SR-MEMO-2671

Estimated thermal conductivity of polyphenyl reactor coolants, by G. Asanovich. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. May 58. 6p. Order from LC. Mi $1.80, ph $1.80.

NAA-SR-MEMO-2743

The presence of argon in terphenyl, by L. B. Gardner and R. L. Koontz. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Dec 58. 6p. Order from LC. Mi $1.80, ph $1.80.

NAA-SR-MEMO-3130

The properties of santowax-r (mixed terphenyl isomers) as organic moderator-coolant, by R. H. J. Gercke, and others. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. (1959?) 76p. Order from LC. Mi $4.50, ph $12.30.

NAA-SR-MEMO-3223

Degasification of nitrogen from santowax r, by G. W. Corporales and P. R. Benson. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Mar 59. 12p. Order from LC. Mi $2.40, ph $3.30.

NAA-SR-MEMO-3652

Method for the analysis of diphenyl-terphenyl organic coolant mixtures by gas chromatography, by R. A. Baxter. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Apr 59. 8p. Order from LC. Mi $1.80, ph 1.80.

NAA-SR-MEMO-3793

Hydrogen density of polyphenyl organic coolants, by R. T. Keen and R. A. Baxter. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. May 59. 16p. Order from LC. Mi $2.40, ph $3.30.

NAA-SR-MEMO-3797

A micro method for the determination of the high boilers fraction in omre coolant, by M. A. Rotheram. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Apr 59 8p. Order from LC. Mi $1.80, ph $1.80.

NAA-SR-MEMO-3816

Adsorption of diphenyl vapors in the presence of steam, by H. M. Gilroy. Atomics International Div., North American Aviation Inc., Canoga Park, Calif. July 59. 9p. Order from LC. Mi $1.80, ph $1.80.

NAA-SR-MEMO-4129

Vapor pressure of polyphenyl coolant and components, by F. C. Silvey. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. July 59. 13p. Order from LC. Mi $2.40, ph $3.30.

NAA-SR-MEMO-4187

Analytical chemistry of the polyphosphates. Period covered: July 16, 1958 to September 30, 1959, by W. Rieman. III. Rutgers University, New Brunswick, N. J. 1959. Contract AT(30-1)-1306. 18p. Order from LC. Mi $2.40, ph $3.30.

NYO-2916

Separation of uranium from bismuth using tris(2-ethylhexyl)phosphine oxide. Increase in selectivity with 1, 2-cyclohexylene dinitrilo tetraacetic acid, by A. H. A. Heyn and G. Banerjee. Boston University, Boston, Mass. Nov 59. Contract AT(30-1)1873. 15p. Order from OTS. 50 cents.

NYO-7569

Reduction of cupric oxide by hydrogen. II. Conversion of hydrogen to water over fixed beds, by W. D. Bond and W. E. Clark. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 17p. Order from OTS. 75 cents.

ORNL-2816

Purification of promethium by liquid-liquid extraction, by B. Weaver and F. A. Kappelmann. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 25p. Order from OTS. 75 cents.

ORNL-2863

Organic compounds in fission reactors. II. Thorio-organic compounds, by W. H. Baldwin. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 6p. Order from OTS. 50 cents.

ORNL-2864

Analytical chemistry division annual progress report for period ending December 31, 1959. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26.

102p. Order from OTS. $2.50.

ORNL-2866

Wavelength table of rare-earth elements and associated elements including zirconium, thorium, hafnium, rhenium, and tellurium, by J. A. Norris. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 739p. Order from OTS. $7.25.

ORNL-2774

Solubility of zirconium dibutyl phosphate in solvent extraction solutions, W. Davis, Jr. and H. H. Carmichael. Oak Ridge National Laboratory, Oak Ridge, Tenn. Jan 60. Contract W-7405-eng-26. 13p. Order from OTS. 50 cents.

ORNL-2857

Comparison of a fluidized-bed and an agitated-trough chemical reactor for producing ThO_2 from $Th(NO_3)_4$, by S. D. Clinton. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 21p. Order from OTS. 75 cents.

ORNL-2875

The catalysis of the hydrogen-oxygen reaction by aqueous slurries of thorium oxide and thorium-uranium oxide, by N. A. Krohn. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 73p. Order from OTS. $2.25.

ORNL-2878

Synthesis and fabrication of refractory uranium compounds. Quarterly report no. 1 for May 13 to August 31, 1959, by K. M. Taylor and others. Carborundum Co. Research and Development Div., Niagara Falls, N. Y. Sep 59. Contract AT(40-1)-2558. 30p. Order from LC. Mi $3.00, ph. $6.30.

ORO-212

Synthesis and fabrication of refractory uranium compounds. Monthly progress report no. 3 for September 1 to September 30, 1959, by K. M. Taylor and others. Carborundum Co. Research and Development Div., Niagara Falls, N. Y. Oct 59. Contract AT(40-1)-2558. 5p. Order from LC. Mi $1.80, ph $1.80.

ORO-213

Preparation of pure americium, by V. A. Ryan and J. W. Pringle. Dow Chemical Co., Rocky Flats Plant, Denver. Jan. 60. Contract AT(29-1)-1106. 24p. Order from OTS. 75 cents.

RFP-130

Sodium fluoride as a spectroscopic carrier for plutonium metal analysis, by A. J. Johnson and E. Vejvoda. Dow Chemical Co. Rocky Flats Plant, Denver, Colo. Apr 59. Decl. July 59. Contract AT(29-1)-1106. 14p. Order from LC. Mi $2.40, ph $3.30.

RFP-143

Electron-spin-resonance and chemical studies of radiation damage of choline chloride and some of its analogs, by R. O. Lindblom. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Oct 59. Contract W-7405-eng-48. 122p. Order from OTS. $2.75.

UCRL-8910

Range and range straggling of heavy recoil atoms, by E. W. Valyocsik. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Nov 59. Contract W-7405-eng-48. 43p. Order from OTS. $1.25.

UCRL-8855

Saline water conversion, 1956-58, compiled by F. G. Bennett IV. Atomic International Division, North American Aviation, Inc. Canoga Park, Calif. Jan 60. 9p. Order from OTS. 50 cents.

NAA-SR-3737

Reactor chemistry and plant materials. Bettis Atomic Power Laboratory, Pittsburgh, Pa. Dec 59. Contract AT-11-1-GEN-14. 201p. Order from OTS. $3.50.

WAPD-BT-16

The determination of titanium as an impurity in zirconium and zircaloy, by D. V. Reed. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. May 59. 5p. Order from LC. Mi $1.80, ph $1.80.

WAPD-CTA-GLA-157

The spectrographic determination of impurities in zirconium and zircaloy using a chromium internal standard, by J. F. Frain and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. June 58. 6p. Order from LC. Mi $1.80, ph $1.80.

WAPD-CTA-GLA-162-7

The spectrographic determination of tin, iron, chromium, and nickel in zircaloy-2 using high voltage spark point-to-plane excitation, by R. M. Jacobs and N. E. Gordon. Westinghouse Electric Corp. Bettis Plant, Pittsburgh Pa. Oct 58. 6p. Order from LC. Mi $1.80, ph $1.80.

WAPD-CTA-GLA-162-12

The spectrographic determination of sodium, lithium, barium, and strontium in zirconium and zircaloy using the silver chloride carrier technique, by R. F. Farrell and G. J. Harter. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Apr 59. 7p. Order from LC. Mi $1.80, ph $1.80.

WAPD-CTA-GLA-162-14

The determination of carbon in zirconium and zirconium base alloys, by K. A. Morrow and E. F. Tretow. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa.

Apr 59. 5p. Order from LC. Mi $1.80. ph $1.80.
WAPD-CTA-GLA-181 (Rev 2)

The determination of tin in zirconium base alloys, by T. M. Reinhold. Westinghouse Electric Corp Corp. Bettis Plant, Pittsburgh, Pa. Aug 59. 4p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-371(Rev 2)

The determination of uranium as an impurity in zirconium and zircaloy, by D. L. Smith and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 59. 5p. Mi $1.80, ph $1.80. Order from LC.
WAPD-CTA-GLA-431 (Rev 2)

The determination of niobium in uranium niobium alloys, by G. W. Goward and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Feb 58, Decl. Nov. 59. 4p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-543

The spectrographic determination of impurities in niobium, by J. A. Featheringham and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 58. 8p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-631-1

Spectrographic determination of tantalum, titanium, and zirconium in niobium, by J. A. Featheringham and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 58. 4p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-631-2

The spectrographic determination of boron and cadmium in niobium, by J. A. Featheringham and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 58. 3p. Mi $1.80, ph $1.80. Order from LC.
WAPD-CTA-GLA-631-3

The spectrographic determination of tungsten in niobium, by J. A. Featheringham and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 58. 3p. Order from LC. Mi $1.80, ph $1.80.
WAPD-CTA-GLA-631-5

The determination of the primary impurities in hafnium by emission spectrographic analysis, by J. F. Frain and others. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. Aug 59. 11p. Order from LC. Mi $2.40, ph $3.30.
WAPD-M-GLA-701-1

Heat of recombination and recombiner exit temperature, by D. F. Rinald. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh and Pennsylvania Power and Light Co. Atomic Engineering Dept., Pittsburgh, Pa. June 57. 6p. Order from LC. Mi $1.80, ph $1.80.
WCAP-567

Design and operation of a catalytic recombiner, by D. F. Rinald. Westinghouse Electric Corp., Atomic Power Dept., Pittsburgh and Pennsylvania Power and Light Co. Atomic Engineering Dept., Pittsburgh, Pa. June 57. 13p. Order from LC. Mi $2.40, ph $3.30.
WCAP-569

The determination of oxygen as an impurity in zirconium and zircaloy, by P. Elbling and G. W. Goward. Westinghouse Electric Corp. Bettis Plant, Pittsburgh, Pa. July 59. 12p. Order from LC. Mi 2.40, ph $3.30.
WAPD-CTA-GLA-592 (Rev 1)

The properties of thoria-heavy water slurries. Part I. Apparent density, heat capacity and thermal conductivity of the ThO_2-D_2O slurries, by R. J. Atkins and others. Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh and Pennsylvania Power and Light Co. Atomic Engineering Dept., Pittsburgh, Pa. Sep 57. 15p. Order from LC. Mi $2.40, ph $3.30.
WCAP-685

The spectrographic detection of trace impurities in beryllium oxide. Interim report, by O. P. Killeen. Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. Aug 59. 12p. Order from LC. Mi $2.40, ph $3.30.
Y-1259

The spectrographic detection of trace impurities in beryllium oxide, by O. P. Killeen. Union Carbide Nuclear Company Division of Union Carbide Corporation Y-12 Plant, Oak Ridge, Tenn. Jan 60. 13p. Order from OTS. 50 cents.
Y-1259 (rev.)

Reduction cell with vertical rotating mercury cathode, by F. A. Schimmel. Union Carbide Nuclear Company Division of Union Carbide corporation Y-12 Plant, Oak Ridge, Tenn. Jan 60. Contract W-7405-eng-26. 21p. Order from OTS. 75 cents.
Y-1285

Chemistry—Radiation and Radiochemistry

Irradiation of radium in MTR, by G. H. Hanson. Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho. Nov 52. Decl. Nov 59. 14p. Order from LC. Mi $2.40, ph $3.30.
IDO-16033

A simplified analytical method for separating traces of fission products from uranium and thorium (UX), by C. A. Kienberger and A. R. Flynn. Carbide and Carbon Chemical

Co. K-25 Plant, Oak Ridge, Tenn. Dec 53. Decl. Nov 59. Contract W-7405-eng-26. 14p. Order from LC. Mi $2.40, ph $3.30.
K-1078

Exploratory studies of hydrazine formation by radioactive ionization, by H. M. Busey. Los Alamos Scientific Lab., N. Mexico. June 51. Decl Nov 59. Contract W-7405-eng-36. 25p. Order from LC. Mi $2.70, ph $4.80.
LA-1376

Substitute materials report for research for July 2, 1951 to October 1, 1951. Mound Laboratory, Miamisburg, Ohio. Nov 51. Contract AT33-1-GEN-53. 50p. Order from OTS. $1.25.
MLM-622(Del 1)

The measurement of uranium concentration in U-Al alloy by gamma counting, by J. W. Wachter and W. B. Wright. Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn. June 54. Decl. Nov 59. Contract W-7405-eng-26. 15p. Order from LC. Mi $2.40, ph $3.30.
Y-1080

Chemistry—Separation Processes for Plutonium and Uranium

Chemical engineering division summary report for January, February, March 1958. Argonne National Lab., Lemont, Ill. June 58. Decl. Nov 59. Contract W-31-109-eng-38. 132p Order from LC. Mi $6.90, ph $21.30.
ANL-5858

Theoretical study of single-transfer line concatenated pulse column systems, by H. F. Johnson. Oak Ridge National Lab., Oak Ridge, Tenn. June 59. Contract W-7405-eng-26. 22p. Order from LC. Mi $2.70, ph $4.80.
CF-56-6-119

Chemical technology division, chemical development, section c, monthly progress report, July 1959, by K. B. Brown and others. Oak Ridge National Lab., Tenn. Aug 59. Contract W-7405-eng-26. 32p. Order from LC. Mi $3.00, ph $6.30.
CF-59-7-68

Chemical technology division, chemical development, section, c, monthy progress report, August 1959, by K. B. Brown and others. Oak Ridge National Lab., Tenn. Sep 59. Contract W-7405-eng-26. 37p. Order from LC. Mi $3.00, ph $6.30.
CF-59-8-45

Uranium recovery from sodium-zirconium fluoride salt mixtures, volatility pilot plant runs L-1 through L-9, by C. L. Whitmarsh. Oak Ridge National Lab., Oak Ridge, Tenn. Sep 59. Contract W-7405-eng-26. 75p. Order from LC. Mi $4.50, ph $12.30.
CF-59-9-2

PRFR pilot plant: An evaluation of equipment performance during the processing of irradiated natural uranium in April 1959, by J. L. Matherne. Oak Ridge National Lab., Oak Ridge, Tenn. Sep 59. 22p. Order from LC. Mi $2.70, ph $4.80.
CF-59-9-49

Manganese dioxide precipitation in uranium-aluminum nitrate solutions, by H. E. Henry. Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C. Feb. 59. Decl. Sep 59. Contract AT(07-2)-1. 12p. Order from LC. Mi $2.40, ph $3.30.
DP-347

A survey of organic solvents for the electrodeposition of plutonium, by J. A. Porter. E. I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, South Carolina. July 59. Contract AT(07-2)-1. 12p. Order from OTS. 50 cents.
DP-389

Reprocessing of power reactor fuels seventh quarterly progress report. April 1 to July 1, 1959. by L. H. Meyer and E. S. Occhipinti. E. I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, South Carolina. Sep 59. Contract AT(07-2)-1. 10p. Order from OTS. 50 cents.
DP-421

Description of purex plant process, by E. R. Irish. Hanford Atomic Products Operation General Electric Company, Richland, Washington. May 59. Contract W-31-109-eng-52. 15p. Order from OTS. 50 cents.
HW-60116

Recovery of plutonium and neptunium from purex IWW by anion exchange, by H. H. Van Tuyl. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. July 59. Decl. with deletions Sept 59. 6p. Order from LC. Mi $1.80, ph $1.80.
HW-61145(Del)

Hanford neptunium oxalate-oxide process experience, by C. W. Pollock and R. A. Schneider. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. July 59. Decl. with deletions Oct 59. Contract AT(45-1)-1350. 11p. Order from LC. Mi $2.40, ph $3.30.
HW-61675(Del)

Preliminary investigation of the Ag-Mg system for recovery of uranium from Th-U alloy, by L. A. Hanson. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. June 59. 16p. Order from LC. Mi $2.40, ph $3.30.
NAA-SR-MEMO-3954

Process for dissolution of borax IV reactor fuel: laboratory development. by L. M. Ferris. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 23p. Order OTS. 75 cents.

ORNL-2821

Thermodynamic properties of the uranium mercurides. by H. C. Forsberg. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd] Contract W-7405-eng-26. 57p. $1.75.

ORNL-2885

The preservation of foods by ionizing radiations. July 27-July 30, 1959. Department of Food Technology Massachusetts Institute of Technology, Cambridge Mass. Nov 59. Contract IAEA/STI/2, 59. 289p. Order from OTS. $4.00.

TID-7585

Controlled Thermonuclear Processes

Ion sources. by J. S. Luce. Oak Ridge National Lab., Oak Ridge, Tenn. Mar 55. Decl. Oct 58. 9p. Order from LC. Mi $1.80, ph $1.80.

CF-55-3-103

A coaxial discharge for multicharged ions. by J. S. Luce. Oak Ridge National Lab., Oak Ridge, Tenn. Nov 55. Decl. Oct 58. 5p. Order from LC. Mi $1.80, ph $1.80.

CF-55-11-135

Compilation of various undocumented classified memoranda on Sherwood program. by J. R. McNally, Jr. Oak Ridge National Lab., Oak Ridge, Tenn. June 57. Decl. Oct 58. Contract W-7405-eng-26. 14p. Mi $2.40, ph $3.30.

CF-57-6-115

Stability of a linear pinch. Part II. by B. R. Suydam. Los Alamos Scientific Laboratory of the University of California, Los Alamos, New Mexico. Feb 60. Contract W-7405-eng-36. 25p. Order from OTS. 75 cents.

LAMS-2381

The application of microwave techniques to stellarator research. by M. A. Heald. Project Matterhorn, Princeton University, Princeton, New Jersey. Aug 59. Contract AT(30-1)-1238. 107p. Order from OTS. $2.50.

MATT-17

Quarterly report covering the period July 1-September 30, 1959. Princeton University, Project Matterhorn, Princeton, N. J. Contract AT(30-1)-1238. 32p. Order from LC. Mi $3.00, ph $6.30.

MATT-Q-8

Sherwood progress report no. 3 for July 1958 to July 1959. by H. Grad and J. Berkowitz. New York University, Atomic Energy Commission Computing and Applied Mathematics Center. July 59. Contract AT(30-1)-1480. 19p. Order from LC. Mi $2.40, ph $3.30.

NYO-2544

B-1 magnetic measurements. Technical Memorandum no. 36. by A. Z. Kranz. Princeton University, Project Matterhorn, Princeton N. J. Nov 56. 7p. Order from LC. Mi $1.80, ph $1.80.

NYO-7878

Measurements on a low-inductance capacitor. by I Mansfield. Stevens Institute of Tech., Hoboken, N. J. May 58. Contract AT(30-1)-1921. 10p. Order from LC. Mi $2.40, ph $3.30.

NYO-8647

Boundary-layer formation in the pinch. by J. Killeen and others. California University, Lawrence Radiation Lab., Livermore, Calif. Aug 59. Contract W-7405-eng-48. 40p. Order from LC. Mi $3.00, ph $6.30.

UCRL-5195 (Rev)

Shielding against magnetic radiation loss from a hot plasma. by J. P. Wesley. California University, Lawrence Radiation Lab., Livermore, Calif. June 59. Contract W-7405-eng-48. 8p. Order from LC. Mi $1.80, ph $1.80.

UCRL-5606

Application of a modified Debyehuckel theory to fully ionized gases. by R. E. Kidder and H. E. De Witt. California Univeristy, Lawrence Radiation Lab., Livermore, Calif. Aug 59. Contract W-4705-eng-48. 16p. Order from LC. Mi $2.40, ph $3.30.

UCRL-5653

Controlled thermonuclear research quarterly report. December 1958, January and February 1959. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Mar 59. Contract W-7405-eng-48. 81p. Order from OTS. $2.25.

UCRL-8682

Criticality Studies

A uranium critical assembly at low U^{235} concentration. by G. A. Lienberger. Los Almos Scientific Lab., N. Mexico. 1956. Decl. June 56. Contract W-7405-eng-36. 14p. Order from LC. Mi $2.40, ph $3.30.

AECD-4285

Eurochemic assistance: Answers to questions on criticality. by E. D. Clayton. Oak Ridge National Lab., Oak Ridge Tenn. Sep 59. 4p. Order from LC. Mi $1.80, ph $1.80.
CF-59-9-3

Criticality of fuels of low enrichment in cylinders. by N. Ketzlach. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Aug 59. 12p. Order from LC. Mi $2.40, ph $3.30.
HW-61547

Critical mass of an OMR core using plate type fuel elements. by H. C. Field. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. June 59. 4p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-3980

Radioactivity in reactor coolants. Interim report. by J. E. Stewart. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. June 59. 8p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-4057

Criticality criteria for fabrication of 2% enriched uranium hollow slugs. by T. S. Moy. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. July 59. 6p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-4099

Suggested experimental facilities for the experimental organic cooled reactor (EOCR). by J. E. Steward. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Sept 59. 25p. Order from LC. Mi $2.70, ph $4.80.
NAA-SR-MEMO-4319

Preliminary power calibration of the OMR critical assembly. by R. J. Tuttle. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Aug 59. 6p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-4267

Prompt neutron lifetime of the aetr critical assembly. by A. V. Campise. Atomics International Div., North American Aviation, Inc., Canoga Park, Calif. Sep 59. 6p. Order from LC. Mi $1.80, ph $1.80.
NAA-SR-MEMO-4272

Plutonium graphite assemblies. by A. Goodwin, Jr., and C. L. Schuske. Dow Chemical Co. Rocky Flats Plant, Denver, Colo. Sep 58. Decl. July 59. Contract AT(29-1)-1106. 25p. Order from LC. Mi $2.40, ph $3.30.
RFP-123

Nuclear safety analyses of a typical production line for high-fired UO_2 at > 4.5% U^{235} isotopic composition, by W. T. Mee and others. Union Carbide Nuclear Company a Division of Union Carbide Corporation, Y-12 Plant, Oak Ridge, Tenn. Sep 59. Contract W-7405-eng-26. 69p. Order from OTS. $1.75.
Y-1273

Health and Safety

An experimental evaluation of the radiation protection afforded by a large modern concrete office building, by J. F. Batter, Jr., and others. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Jan 60. 61p. Order from OTS. $1.50. CEX-59.1

Radiochemical analysis of marine biological samples following the "Redwing" shot series - 1956, by C. W. Thomas and others. Hanford Atomic Products Operation, Richland, Wash. Dec 58. Contract W-31-109-Eng-52. 81p. Order from OTS. $2.25. HW-58674

Nuclear safety in manufacturing plants, by J. E. McLaughlin. Health and Safety Laboratory, AEC New York Operation Office, New York, N. Y. Nov 59. 24p. Order from OTS. 75 cents.
HASL-66

Further investigations of natural environmental radiation, by L. R. Solon and others. Health and Safety Laboratory, New York Operation Office, New York, N. Y. Nov 59. 32p. Order from OTS. $1.00. HASL-73

Quarterly progress report research and development activities in the field of radiological sciences, April - June, 1959, by Members of the Staff of the Hanford Laboratories Operation. Hanford Atomic Products Operation, Richland, Wash. July 59. Contract AT(45-1)-1350. 42p. Order from OTS. $1.25. HW-61247

Calculation of temperature rise in deeply buried radioactive cylinders, by J. J. Perona, and M. E. Whatley. Oak Ridge National Laboratory, Oak Ridge, Tenn. Feb 60. Contract W-7405-eng-26. 43p. Order from OTS. $1.25. ORNL-2812

The fabrication of radioactive sources, by A. E. Salo and N. B. Garden. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Oct 59. Contract W-7405-eng-48. 31p. Order from OTS. $1.00. UCRL-8928

Neutron exposure dosimetry of humans by in vivo gamma measurement of sodium-24, by R. E. Cofield. Union Carbide Nuclear Co. Division of Union Carbide Corp. Y-12 Plant, Oak Ridge, Tenn. Sep 59. Contract W-7405-eng-26. 19p. Order from OTS. 75 cents. Y-1283

Instruments

Molecular ion source, by J. S. Luce. Oak Ridge National Lab., Oak Ridge, Tenn. Nov 55. Contract W-7405-eng-26. 6p. Order from LC. Mi $1.80, ph $1.80. CF-55-11-160

Metallographic examination of high velocity heat exchanger (SHE no. 1), by R. J. Gray. Oak Ridge National Lab., Oak Ridge, Tenn. May 56. Decl. Oct. 9, 1959. 14p. Order from LC. Mi $2.40, ph $3.30. CF-56-5-148

Examination of ORNL 1 and 2 intermediate heat exchangers, Type IHE-3, by J. H. DeVan and R. S. Crouse. Oak Ridge National Lab., Oak Ridge, Tenn. July 56. Decl. Oct. 9, 1959. 17p. Order from LC. Mi $2.40, ph $3.30. CF-56-7-135

Testing of dump valve trim in the valve test loop and the performance of dump valves in the HRT, by E. C. Hise. Oak Ridge National Lab., Oak Ridge, Tenn. Aug 59. 10p. Order from LC. Mi $1.80, ph $1.80. CF-59-8-86

Water wheel river and stream sampler, by K. J. Travers. E. I. du Pont de Nemours & Co. Explosives Department. Atomic Energy Div., Technical Div., Savannah River Laboratory, Aiken, S. C. Order from OTS $.50 DP-426

Continuous electrochemical determination of oxygen in gases, by K. Koyama. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. May 56. Decl. with deletions Apr 6, 1959. Contract W-31-109-Eng-52. 14p. Order from LC. Mi $2.40, ph $3.30. HW-42636(Del.)

A liquid-contact scintillation alpha counter, by U. L. Upson and P. E. Brown. Hanford Atomic Products Operation, Richland, Wash. Mar 59. Decl. with deletions Nov 17, 1959. Contract W-31-109-Eng-52. 52p. Order from OTS. $1.50. HW-49003(Del.)

A method of determining the thermal conductivity of incandescent solids, by B. B. Brenden and H. W. Newkirk. General Electric Co., Hanford Atomic Products Operation, Richland, Wash. Mar 59. Contract W-31-109-Eng-52. 41p. Order from LC. Mi $3.30, ph $7.80. HW-59574

Interim report on investigation of dynamic characteristics of relays, covers the period 1 September to 31 October, by School of Electrical Engineering Oklahoma State University, Stillwater, Okla., for Sandia Corporation, Albuquerque, N. Mex. Jan 60. 111p. Order from OTS. $2.75. SC-4390(RR)

Creepage test of SR-4 strain gages under high steady state strains, by L. L. Lathrop. Sandia Corp., Albuquerque, N. Mex. June 55. 4p. Order from LC. Mi $1.80, ph $1.80. SCTM-132-55-52

Broadband pulse transformer with millimicrosecond rise time, by E. N. Pinson. Dandia Corp., Albuquerque, N. Mex. Sep 55. 15p. Order from LC. Mi $2.40, ph $3.30. SCTM-197-55-51

Zero shift in piezoelectric transducers, by P. E. Scarborough, Jr. Sandia Corp., Albuquerque, N. Mex. Oct 59. 16p. Order from LC. Mi $2.40, ph $3.30. SCTM-315-59-16

An electroluminescent transducer, by L. C. Meyer. Sandia Corp., Albuquerque, N. Mex. Aug 59. 44p. Order from LC. Mi $3.30, ph $7.80. SCTM-326-59-52

Hot laboratories. A literature search, by R. L. Scott. Atomic Energy Commission, Technical Information Service Extension, Oak Ridge, Tenn. Jan 60. 12p. Order from OTS. $1.00. TID-3545

Metallurgy

Study of factors influencing ductility of iron-aluminum alloys. Monthly letter report no. 5 for March 15, 1959 to March 15, 1960, by G. Rauscher, and others. University of Denver, Denver Research Institute, Denver, Colo. Sep 59. Contract AT(11-1)-742. 12p. Order from LC. Mi $2.40, ph $3.30. AECU-4335

Electrochemical studies of hafnium, zirconium and yttrium. Quarterly progress report no. 8 for April 1, 1959 to June 30, 1959. Bureau of Mines. Reno Metallurgical Research Center, Nev. and Bureau of Mines. Boulder City Metallurgy

Research Lab., Nev. 1959. Contract AT(11-1)-475. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4368

Electrochemical studies of hafnium, zirconium, and yttrium. Quarterly progress report no. 7, for November 1, 1958 to March 31, 1959. Bureau of Mines. Electrometallurgical Experiment Station, Boulder City, Nev. 1959. Contract AT(11-1)-475. 14p. Order from LC. Mi $2.40, ph $3.30. AECU-4372

Measurement of the equilibrium concentration of lattice vacancies in aluminum. Technical report no. 17, by R. O. Simmons and R. W. Balluffi. University of Illinois, Urbana, Ill. July 59. Contract AT(11-1)-182. 35p. Order from LC. Mi $3.00, ph $6.30. AECU-4374

Measurements of the high temperature electrical resistance of aluminum: The resistivity of lattice vacancies. Technical report no. 18, by R. O. Simmons and R. W. Balluffi. University of Illinois, Urbana, Ill. July 59. Contract AT(11-1)-182. 28p. Order from LC. Mi $2.70, ph $4.80. AECU-4375

Diffusionless phase changes in nonferrous metals and alloys. Technical progress report for April 1, 1956 to February 28, 1957, by T. A. Read and others. University of Illinois, Urbana, Ill. Mar 57. Contract AT(11-1)-67. 63p. Order from LC. Mi $3.90, ph $10.80. AECU-4392

Diffusionless phase changes in nonferrous metals and alloys. Technical progress report for March 1, 1957 to March 31, 1958, by T. A. Read and others. University of Illinois, Urbana, Ill. Apr 58. Contract AT (11-1)-67. 46p. Order from LC. Mi $3.30, ph $7.80. AECU-4393

Diffusionless phase changes in nonferrous metals and alloys. Technical progress report for period April 1, 1958 to April 30, 1959, by T. A. Read and others. University of Illinois, Urbana, Ill. 1959. Contract AT(11-1)-67. 198p. Order from LC. Mi $8.70, ph $30.30. AECU-4394

Diffusionless phase changes in nonferrous metals and alloys, Progress report for the period October 15, 1954 to July 15, 1955, by T. A. Read and others. University of Illinois, Urbana, Ill. July 55. Contract AT(11-1)-67. 5p. Order from LC. Mi $1.80, ph $1.80. AECU-4398

Technical progress report on diffusionless phase changes in nonferrous metals and alloys for period July 16, 1955 to March 31, 1956, by T. A. Read and others. University of Illinois, Urbana, Ill. Mar 56. Contract AT(11-1)-67. 6p. Order from LC. Mi $1.80, ph $1.80. AECU-4399

Study of factors influencing ductility of iron-aluminum alloys. Monthly report no. 6, by F. C. Perkins and J. F. Nachman. University of Denver. Denver Research Inst., Denver, Colo. Oct 59. Contract AT(11-1)-742. 9p. Order from LC. Mi $1.80, ph $1.80. AECU-4400

UO_2 bearing fuel plates. Progress report for September 1, 1959 through September 30, 1959, by G. J. Comstock. Stevens Inst. of Tech., Hoboken, N. J. Oct 59. Contract AT(30-1)-2258. 7p. Order from LC. Mi $1.80, ph $1.80. AECU-4410

The mechanical properties of yttrium, scandium and rare earth metals, by C. R. Simmons. General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. Nov 59. 55p. Order from LC. Mi $3.60, ph $9.30. AECU-4423

Forming and fabrication of yttrium metal, by J. M. Williams and C. L. Huffine. General Electric Co., Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. Nov 59. 12p. Order from LC. Mi $2.40, ph $3.30. AECU-4427

The determination of the equilibrium phase diagram, zirconium-niobium, by C. E. Lundin. University of Denver, Denver Research Institute, Denver, Colo. Nov 59. Contract AT(11-1)-752. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4448

Magnesium oxide (MgO), by C. F. Barrett, Jr. Knolls Atomic Power Lab., Schenectady, N. Y. Mar 54. 2p. Order from LC. Mi $1.80, ph $1.80. AECU-4456

Study of factors influencing ductility of iron-aluminum alloys. Monthly letter report no. 7, by F. C. Perkins and J. F. Nachman. University of Denver, Denver Research Institute, Denver, Colo. Nov 59. Contract AT(11-1)-742. 10p. Order from LC. Mi $1.80, ph $1.80. AECU-4467

Pure metals project, zirconium and hafnium program. Quarterly progress reports no. 1 through 6 for November 1, 1956 to June 30, 1958. Bureau of Mines. Electrometallurgical Experiment Station, Boulder City, Nev. [nd] Contract AT(11-1)-475. 72p. Order from LC. Mi $4.50, ph $12.30. AECU-4468

Status report on a study of the use of furnace calorimetry for the rapid determination of specific heat of solids at high temperatures, by J. H. Boggs and J. A. Wiebelt. Oklahoma State University, School of Mechanical Engineering, Stillwater, Okla. Nov 59. Contract AT(11-1)-71. 9p. Order from LC. Mi $1.80, ph $1.80.
AECU-4473

Techniques for X-ray examinations of weld closures and can-to-cap brazes on CP-6 type fuel elements. Final report, by S. S. Sidhu. Argonne National Lab., Lemont, Ill. Jan 54. Decl. Nov 30, 1959. Contract W-31-109-eng-38. 16p. Order from LC. Mi $2.40, ph $3.30. ANL-4987

Eddy current and ultrasonic testing of CP-6 fuel elements, by W. J. McGonnagle and W. B. Doe. Argonne National Lab., Lemont, Ill. Dec 53. Decl. Nov 30, 1959. Contract W-31-109-eng-38. 208p. Order from LC. Mi $9.30, ph $31.80. ANL-5161

Testing of fuel element parts and assemblies by the radiographic method, by R. H. VanderLaan. Argonne National Lab., Lemont, Ill. July 54. Decl. Jan 1, 1960. Contract W-31-109-eng-38. 15p. Order from LC. Mi $2.40, ph $3.30.
ANL-5279

Fuel development for the treat reactor, by R. C. Lied and J. H. Handwerk. ARgonne National Laboratory, Lemont, Ill. Jan 60. Contract W-31-109-eng-38. 19p. Order from OTS. 75 cents. ANL-5960

The fabrication of the fuel elements for the transient reactor test, by C. H. Bean and others. Argonne National Lab., Lemont, Ill. June 59. 30p. Order from LC. Mi $2.70, ph $4.80.
ANL-FGF-162

Progress report for the month of January 1952, by H. W. Russell and others. Battelle Memorial Institute, Columbus, Ohio. Feb 52. Decl. with deletions Apr 18, 1957. Contract W-7405-eng-92. 48p. Order from LC. Mi $3.30, ph $7.80.
BMI-726(Del.)

Progress report for the month of February 1952, by H. W. Russell and others. Battelle Memorial Institute, Columbus, Ohio. Mar 52. Decl. with deletions Apr 18, 1957. Contract W-7405-eng-92. 43p. Order from LC. Mi $3.30, ph $7.80.
BMI-731(Del.)

The ductility of brazed stainless steel joints, by H. A. Saller and others. Battelle Memorial Institute, Columbus, Ohio. July 53. Decl. Nov 20, 1959. Contract W-7405-eng-92. 8p. Order from LC. Mi $2.40, ph $3.30.
BMI-847

Survey of materials for supercritical-water reactor, by M. C. Udy and F. W. Bougler. Battelle Memorial Inst., Columbus, Ohio. Nov 53. Decl. Aug 10, 1959. Contract W-7405-eng-92. 52p. Order from LC. Mi $3.30, ph $7.80.
BMI-890

The fabrication of stainless steel-uranium dioxide fuel elements, by J. R. Keeler and others. Battelle Memorial Inst., Columbus, Ohio. Mar 54. Decl. Aug 10, 1959. Contract W-7405-eng-92. 28p. Order from LC. Mi $2.70, ph $4.80.
BMI-904

Electroplated metals on uranium, by J. G. Beach and others. Battelle Memorial Inst., Columbus, Ohio. May 54. Decl. with deletions June 18, 1959. 33p. Order from LC. Mi $3.00, ph $6.30
BMI-912 (Del.)

The fabrication of subassemblies for the supercritical-water reactor, by J. R. Keeler and A. W. Hare. Battelle Memorial Inst., Columbus, Ohio. Aug 54. Decl. Aug 10, 1959. Contract W-7405-eng-92. 30p. Order from LC. Mi $2.70, ph $4.80. BMI-919

Extrusion cladding of fuel elements, by C. J. Slunder and others. Battelle Memorial Inst., Columbus, Ohio. Mar 55. Decl. Feb 10, 1960. Contract W-7405-eng-92. 33p. Order from OTS. 50 cents. BMI-989

Electroplated metals on uranium for aluminum cladding, by J. C. Beach and others. Battelle Memorial Inst., Columbus, Ohio. May 55. Decl. Feb 11, 1960. Contract W-7405-eng-92. 28p. Order from OTS. 50 cents. BMI-996

Further studies on large-batch melting of uranium, by G. W. Rengstorff and H. W. Lownie, Jr. Battelle Memorial Inst., Columbus, Ohio. July 55. Decl. Feb 11, 1960. 31p. Order from OTS. 50 cents. BMI-1015

Enamels and enameling techniques for coating uranium slugs, by H. P. Tripp and others. Battelle Memorial Inst., Columbus, Ohio. Aug 55. Decl. Feb 11, 1960. Contract W-7405-eng-92. 18p. Order from OTS. 50 cents.
BMI-1024

Particle Accelerators and High-Voltage Machines

Megatron accelerator progress report, by K. C. Rogers and others. Stevens Inst. of Tech., Hoboken, N. J. Aug 59. Contract AT(30-1)-2410. 19p. Order from LC. Mi $2.40, ph $3.30. AECU-4406

Quarterly report of the laboratory director for the period July 1, 1959 to September 30, 1959. Midwestern Universities Research Assn., Madison, Wis. 1959. 10p. Order from LC. Mi $1.80, ph $1.80. AECU-4446

Particle accelerator division summary report for November, 1958 through May, 1959, by A. V. Crewe and others. Argonne National Laboratory, Lemont, Ill. Dec 59. Contract W-31-109-eng-38. 42p. Order from OTS. $1.25. ANL-6032

Current sources for scaling magnetic fields (II), by Midwestern Universities Research Association, Madison, Wis. Dec 59. Contract AT(11-1)-384. 10p. Order from OTS. 50 cents. MURA-539

Scatterbrain--an automated experiment on the 90-inch cyclortron, by J. Benveniste and others. University of California. Raidation Laboratory, Livermore, Calif. Oct 58. Contract W-7405-eng-48. 18p. Order from LC. Mi $2.70, ph $4.80. UCRL-5311

Epoxy plastics, by J. W. Bryan and R. A. Perkins. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. Dec 59. Contract W-7405-eng-48. 12p. Order from OTS. 50 cents. UCRL-9020

Physics and Mathematics

Power from Radioisotopes, by K. P. Johnson. Martin Co. Nuclear Div., Baltimore, Md. 1958. 18p. Order from LC. Mi $2.40, ph $3.30. AECU-4373

Studies of the optical absorption spectrum of rutile single crystals, Technical report no. 140, by B. H. Soffer. Massachusetts Institute of Tech., Lab. for Insulation Research, Cambridge, Mass. Aug 59. Contract AT(30-1)-1937. 25p. Order from LC. Mi $2.70, ph $4.80. AECU-4377

An experimental evaluation of the effect of length-to-width ratio on the critical flow velocity of single plate assemblies, by W. L. Zabriskie. General Electric Co. General Engineering Lab., Schenectady, N. Y. Sep 59. 60p. Order from LC. Mi $3.90, ph $10.80. AECU-4388

On the decay interaction of strange particles, by B. Sakita and S. Oneda. University of Wisconsin. Madison, Wis. and University of Maryland, College Park, Md. 1959. 15p. Order from LC. Mi $2.40, ph $3.30. AECU-4411

Pulsed neutron measurements on plexiglas, by K. W. Seemann. General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati, Ohio. June 59. 14p. Order from LC. Mi $2.40, ph $3.30. AECU-4416

Hydrodynamic aspects of boiling heat transfer (thesis) by N. Zuber. University of California, Research Laboratory, Los Angeles and Ramo--Wooldridge Corp., Los Angeles, Calif. June 59. 196p. Order from OTS. $2.00. AECU-4439

The overhauser effect in paramagnetic systems, by W. A. Barker. Argonne National Laboratory, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 36p. Order from OTS. $1.00. ANL-6069

Fundamental components of the "pace" analog computer, by W. E. Scott. Argonne National Laboratory, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 55p. Order from OTS. $1.50. ANL-6075

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